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AERIAL AGE WEEKLY

VOL. 15, No. 1 MARCH 13, 1922 10 CENTS A COPY

Remarkable Airscape of Niagara Falls Taken from an Altitude of 800 Feet

Plans of the Aeronautical Chamber of Commerce—Aerial Photography—Operation of Aeroplanes Over Forested Areas

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March 27, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 3

TABLE OF CONTENTS

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Curtiss

Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	$3000.00 F.O.B. Buffalo, New York
With K-6 Motor (1919)	4400.00 F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	4800.00 F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	5200.00 F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	5800.00 F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	3600.00 F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	3000.00 F.O.B. Buffalo, New York

Government Training Planes

JN's:	
JN4D with new OX5 Motor	$2400.00 F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	$650.00 to 2200.00 F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	$2000.00 F.O.B. Houston, Texas
With overhauled OX5 Motor	1700.00 F.O.B. Houston, Texas
Without motor, rebuilt for OX5	1100.00 F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	1600.00 F.O.B. Garden City, L. I.
Without motor, as received from Government	800.00 F.O.B. Houston, Texas
MOTORS:	
OX5 New	$800.00 F.O.B. Various concentration fields
OX5 Overhauled	600.00 F.O.B. Various concentration fields
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THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which Flying *is consolidated*

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VOL. XV NEW YORK, MARCH 27, 1922 No. 3

Urges National Airway System for the United States

BRIGADIER-GENERAL WILLIAM MITCHELL, assistant chief of the Air Service, recently returned from Europe, where he made a very comprehensive survey of aerial activities. In a statement issued at the offices of the Aeronautical Chamber of Commerce he urged the establishment of a system of national airways in the United States. He said, in part:

"Europe is making great strides in the development of aviation, but in its actual application, as illustrated by the bombing manoeuvers last summer, we are in the lead. What the United States needs is an organized system of airways, Federal laws and some form of tangible encouragement for its civilian operators. Some 12 or 15 aircraft lines are in operation in England, France, Holland, Belgium and Italy. The air port of London (Croydon) and Paris (Le Bourget) are well organized and sÿstematically conducted, with customs houses, hotels and means of communication with the city. People in Europe are patronizing the air lines as a utility. During the month of February about 1,400 passengers were cleared at the Paris Air Port. The French are running the longest lines—Paris to Bucharest, with an extension to Constantinople. In all the larger European nations aviation is being developed with the idea that it is the first line of defense, and subsidies of 50 per cent. or so on the original cost and the cost of operation are in effect for privately owned aircraft.

"There is no visible aviation in Germany, but they are doing great things there. The gliding flights are evolving types with motors of only 5 h.p., which means a very cheap ship.

"The French intend and the Germans expect to fly the Atlantic. Airships have not been scrapped, but are sure to be the long distance carriers. The German-Spanish-Argentine Zeppelin line between Seville and Buenos Aires is going through."

General Mitchell flew in every country visited, personally testing out some fifteen new types of aircraft, again demonstrating that the affairs of the Army Air Service are in good hands, for General Patrick and General Mitchell are both practical and efficient aeronautic enthusiasts.

Modern Forest Fire Fighting

WE have editorially urged on more than one occasion the greater utilization of aircraft for forest fire patrol, and we are glad to have the following comment from Paul G. Redington, district forester at San Francisco:

"Special flights over and around large fires to get a comprehensive view of the situation are of inestimable value. Very often we have fires in such rough and inaccessible country that it would take a day or even more for the man in charge to get around them, size up the situation and determine his plan of attack. Of course in the meantime the situation might entirely change, and he would be little better off than when he started. If, however, he makes use of a plane he can, in an hour or less, get an accurate picture of the fire, and can immediately so dispose of his forces as to attack it most effectively. Such flights should of course be made with the man in charge of the fire or an experienced fire fighter as observer, since a great deal will depend upon his personal judgment. If desired, an emergency radio station can be established on the fire line and direct communication may be had from the plane to the ground. All pilots are radio operators, so that if the forest officer who is flying as observer is not qualified in this respect he can write out the messages and hand them to the pilot for sending. However, even if no radio is used there is very little delay in the dispatching of the information gained, since a plane traveling at ninety miles an hour will return to a landing field in a few minutes, and the observer can then report by phone or in person."

A New Gas for Airships

CURRENIUM is the name given a new gas for airships, which has been developed by Dr. Edward Curran, head of the research department of the International Transportation and Manufacturing Company, of Los Angeles, which controls the formula and all rights in the product. It is the result of several years' work by Dr. Curran, who is a chemist, and who produced the gas successfully in 1918. The company owning the formula is preparing to engage in the manufacture of the gas, by an electrolytic process at a cost, it is estimated, about $100.00 per thousand cubic feet less than it costs to produce helium.

We expect to present to our readers next week more comprehensive information concerning this important new development in the lighter-than-air field.

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THE NEWS OF THE WEEK

To Fly from Lisbon to Rio

Lisbon — Three Portuguese cruisers left March 25 to station themselves at different points in the Atlantic Ocean to act as a convoy for two Portuguese officers who will attempt to fly a hydroaeroplane from Lisbon to Rio Janeiro.

The date of the start of the flight has not been definitely fixed, but the aviators hope with favorable weather conditions they will be able to make the trans-Atlantic passage of more than 4,000 miles in sixty hours. The machine they will use will develop 360 horsepower and is expected to attain a speed of 80 miles an hour.

The route of the aviators will be from Lisbon to the Canary Islands, thence to the Cape Verde Islands, from there to Fernando Noranha, a short distance northeast of Pernambuco, and then southward to Rio.

Pescara Helicopter Ascends

Paris — At a private trial before a number of French flight experts and airmen Marquis Pateras Pescara on March 22 succeeded in raising himself with his helicopter to a height of six feet from the ground. The trial was made inside a big airship shed at Issy les Moulineaux and was considered more difficult than if it had been made in the open air, as the revolution of the lifting wings caused an enormous back pressure from the sides of the building. The inventor further handicapped himself by agreeing to rise and land within a circle ten meters in diameter.

At the first attempt the helicopter, which is the same as that tested at Barcelona last Summer, rose fifty centimeters. It was found that the engine had got too hot. When the air in the building was cooled a second attempt was made, and the marquis rose to a height between three and five feet several times in succession, always landing within the prescribed circle, although the helicopter showed a tendency to tilt backward. At the third attempt it rose vertically to a height of two meters and landed without the least shock. The only fault found by the experts was the tendency of the machine to tilt backward on landing; and this, it was explained, was more the fault of the inventor, who is not an expert pilot, than of his machine.

The Marquis is completely satisfied with his achievement and intends to begin the construction of a second machine which, as well as rising vertically, will be capable of lateral flight.

Flying Club Names Field for Albert Bond Lambert

The Flying Club of St. Louis at a dinner meeting recently voted to name its field at Bridgeton, Mo., in St. Louis County the Albert Bond Lambert Field in honor of Albert Bond Lambert, president of the Lambert Pharmacal Company and a St. Louis airman of national prominence.

Judge Daniel G. Taylor, vice president of the Missouri Aeronautical Society, an organization with which Lambert has long been affiliated, made the principal address. He mentioned Lambert's conspicuous service for aeronautics in Missouri and spoke briefly of the record which the Flying Club has made.

A number of flyers from Scott Field attended. Among the speakers were Maj. A. E. Stocker, commandant of the aerial reserves in St. Louis. About seventy-five attended the meeting.

The program was concluded with the official air service moving pictures of the bombing tests carried out in Hampton Roads last summer.

British Airship Is Offered to Us

London.—A proposal for the participation of the United States Government in the purchase of one of the British airships was made March 22 by Major G. H. Scott, pilot of the R-34 on her two successful transatlantic flights, to Commander White, one of the Naval Attaches here. Commander White has transmitted the suggestion to Washington.

Major Scott expressed his willingness, The New York Times correspondent understands, to negotiate the taking over of the airship from Great Britain if he receives American backing to raise and train a crew here and navigate the ship himself across the Atlantic. He believed he could interest British financiers in the plan, but it would be necessary to ascertain the attitude the United States authorities would assume toward the project before entering upon financial details.

The British Government has at present five airships, the R-33, R-36, R-37, R-80 and L-71.

Of these the R-36 is fitted up as a passenger ship with sleeping and dining equipment, while the L-71, which was taken over from the Germans, needs a new gas bag. They are all now for sale without restriction, after the British Government had come to the conclusion that it could not afford to run airships as a part of its military equipment.

Navy Exhibits Model of Pulitzer Winner

Washington—A model of the Curtiss-Navy racer, winner of the Pulitzer Trophy race at Omaha on Nov. 3 of last year, has just been presented to the Navy Department.

The plane is a joint production of the Curtiss Company and the Navy Department, built for the navy. This speedy plane is powered by a new twin six Curtiss engine.

In the Pulitzer race the plane was piloted by Bert Acosta for the Curtiss Company. Acosta covered the 150 mile course in 52 minutes 9 3-5 seconds, or at an average speed of 176 miles per hour.

Acosta was the first to get away in the race, and at no point lost his lead. Naval flying experts were greatly impressed with the performance of the Curtiss-Navy racer, which was loaned by the Navy Department to the Curtiss Company to be flown in the Pulitzer race.

Amundsen Tests Plane

Capt. Roald Amundsen, the arctic explorer, who left Mineola Field in a Larsen monoplane shortly after noon March 30, reached Bolling Field at 2:55 o'clock the same day. Some rather severe weather was encountered on the trip from New York to Washington. For about 150 miles after the plane left Philadelphia snow and sleet with rains were encountered, the weather was quite thick and it was necessary for the pilot to fly the plane just over the housetops in the trip. Near Baltimore, however, the weather cleared up and the trip was made with comparative quickness on to Washington.

Amundsen will take this machine into the Arctic when he starts his long drift across the polar regions next summer. John M. Larsen, owner of the model, has presented the plane to Amundsen and the explorer has expressed great satisfaction at obtaining a machine which has created such a marvelous endurance record.

Mapping Air Route from U. S. to Canal Zone

The War Department is working out an air route from the United States to the Panama Canal Zone by way of Havana. The plan is part of the defense plans of the zone, which include the establishment of an elaborate air base there.

The plan is to establish a base by arrangement with Cuba at Havana, from which point it is believed the airmen could hop off to British Honduras and thence to Costa Rica, making the Canal Zone on the last lap. This would obviate the necessity of arranging for a landing base in Mexico.

Spokane News

Spokane, Wash.—The Litzenherger Brothers, Endicott wheat farmers, landed in Spokane by aeroplane recently to secure a competent woman cook for their farm operations. They had planned to take the successful applicant back with them via the air lanes, but the idea of daring the high places did not appeal to the material available and more prosaic methods of transportation were insisted on.

Fourth Aviators' Ball

Plans for the fourth annual aviators' ball, to be held at the Hotel Astor on Monday evening, April 24, are rapidly swing-

COMING AERONAUTICAL EVENTS

AMERICAN

Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.

May —National Balloon Race.

Sept. 4.—(*about*) Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)

Sept. 15.—(*about*) Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)

Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1.—(*about*) Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Venice.

Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.

Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

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ing into shape, and give promise of making the ball, as it always has been, a brilliant close to the Winter's social season. The patronesses and the committee chairmen include Mrs. Charles Dana Gibson, head of the patroness committee; Barbara Brokaw, of the junior committee; Emily Chauncey, of the entertainment committee; J. Philip Roosevelt, of the Army aviators' committee; H. Rogers Benjamin, of the Naval aviators' committee, and Emerson MacMillin, treasurer of the hall.

Other patronesses are Mrs. Laurence La T. Briggs, Mrs. R. Drace White, Mrs. Edward Breitung, Mrs. Rogers Benjamin, Mrs. Henry S. Zuckerman, Mrs. Donn Barber, Mrs. Charles T. Barney, Mrs. Gutzon Borglum, Mrs. Marie Bernard, Mrs. Elihu Chauncey, Mrs. John Daniel, Mrs. Charles de Rham, Mrs. Nelson Doubleday, Mrs. Henry H. Flagler, Mrs. Lyttleton Fox, Mrs. R. Horace Gallatin, Mrs. Henry F. Godfrey, Mrs. Enrico Caruso, Mrs. Jay Gould, Mrs. Emanuel Gurlie, Mrs. E. M. House, Mrs. Otto Kahn, Mrs. Goodhue Livingston, Mrs. John Lee, Mrs. John Purroy Mitchel, Mrs. John B. Marsh, Mrs. J. P. Meuer, Mrs. Lewis Gouverneur Morris, Mrs. James Lowell Putnam, Mrs. George B. Post, Mrs. H. Rivington Pyne, Mrs. Monroe D. Robinson, Mrs. Theodore Roosevelt, Jr.; Mrs. Phillip Rhinelander, 2nd; Mrs. Malcolm Sloane, Mrs. Morton L. Schwartz, Mrs. George B. St. George, Mrs. Samuel Wagstaff and Mrs. Henry Rogers Winthrop.

Among those who will serve on the junior committee are Barbara Brokaw, Elizabeth Andrade, Ellin Mackay, Jeanne Reynal, Helen Meurer, Alice Beadleston, Louise Wilson, Marion de Rham, Gabrielle Gourd, Margherita De Vecchi and Mrs. Thomas Finletter.

Plan Air Service to Atlantic City

Regular daily air service between the Ritz-Carlton Hotels in New York and Atlantic City will be inaugurated in a few days. According to C. N. Reinhardt, who is in charge of the arrangements, passengers desiring to travel by air from New York to Atlantic City will have the choice of land and water routes. Five and ten passenger planes will be used. Eventually the regular service may be extended to Washington, Philadelphia and other cities. Bookings already have been made at the Ritz-Carlton here.

A year ago the rate for an air trip to Atlantic City was $100, but the new rate probably will be about $35. The machines will be chartered from established companies, including the American Airways Company, of which Mr. Reinhardt is a Director. This company, he says, has available ten five-passenger H-S-2-L planes of the navy bomber type, and soon will have ready six more machines, including two Curtiss flying boats of the two-passenger type. It is also planned to acquire a twelve-passenger flying boat from the American Transoceanic Company, and fast Leoning machines and probably some Fokker monoplanes. "The flying boats," said Mr. Reinhardt, "will start from Eighty-third Street and the Hudson River. If the Fokkers are employed, they will take on their passengers at Garden City, L. I. Passengers booked at the Ritz-Carlton Hotel will be transported by motor car to the points of departure, where they will be placed aboard the flight machines."

Mr. Reinhardt said that the reduction in the rate for air transportation had been made possible by the low price at which the Navy Department is selling its surplus stock of air machines. ,"The larger flying boats of the ten-passenger size, which cost the Government in the neighborhood of $30,000," he said, "can be bought for $6,120. The two-passenger flying boats, which were acquired by the Government at prices up to $13,000, can be obtained for as little as $2,000.

"I have been informed that the attractive prices at which these flying machines are offered to the public by the Government have created a great demand for aeroplanes," he added, "and that more than a dozen individuals within the last three weeks have bought planes from the big stock awaiting disposal at the Philadelphia Navy Yard. Most of these machines are brand new."

St. Louis Club Banquet

The Flying Club of St. Louis held their Monthly Banquet at the Hotel Claridge, March 13, and a very pleasant evening was enjoyed by all those present.

About 250 members including friends and also a number of officers and enlisted men were present from Scott field. Several short talks were made by the officers from Scott field, the Flying Club also renamed their flying field which was opened last December to be named Lambert field in honor of Major Lambert of St. Louis who has been a big figure in aviation for a number of years.

The club is starting a drive on for new members and it is the hope of the club to increase its membership by 100 per cent.

Moving pictures were shown of the Bombing tests that took place last June.

The Flying Club's new field at Bridgton, Mo., will be the scene of much flying this summer, and a number of interesting events will take place there.

Witchita Falls Meet

An aviation meet and carnival is being planned for Wichita Falls by the local American Legion Post, and will be held April 29-30. It is expected that thirty planes will participate. Government planes from Fort Sill will co-operate.

AERONAUTICS IN CONGRESS

The following memorandum concerning the progress of aeronautic matters in Congress has been prepared by the Aeronautical Chamber of Commerce.

Feb. 8. *Senate*—Mr. Jones of Washington introduces S. 3076, a bill to establish a bureau of Aeronautics in the Department of Commerce for the purpose of making it unfinished business.

Feb. 11. *Senate*—Appropriation for the National Advisory Committee for Aeronautics struck out of Executive and Independent executive bureau bill (H. R. 9981) by the Senate because of the pending bill S. 3076 to create a bureau of aeronautics in the Department of Commerce. Which brought up question of the need of the National Advisory Committee for Aeronautics.

Feb. 13. *Senate*—S. 3076, a bill to create a bureau of civil aviation in the Department of Commerce discussed in the Senate.

Feb. 14. *Senate*—S. 3076 passed the Senate 34 yeas and 16 nays.

Feb. 15. *House*—Message from the Senate that it had passed S. 3076 and wished concurrence of the House.

Feb. 20. *Senate*—Correspondence between Secretary Hoover and the Attorney General regarding trade associations inserted in the record.

Feb. 28. *House*—Mr. Hicks: a bill (H. R. 10617) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

March 1. *House*—Petition 4368. By Mr. Frothingham: Resolution passed by the Quincy (Mass) Chamber of Commerce, praying for the converison of the cruiser Lexington to an aircraft carrier; to the Committee on Naval Affairs.

Petition 4380. Petition of the Commercial Aircraft Association of Southern California, Los Angeles, California, indorsing and urging support of the Hicks bill (H. R. 2815) a bill to create a bureau of civil aviation in the Department of Commerce; to the Committee on Interstate and Foreign Commerce.

March 3. *Senate*—Mr. Lodge presented petitions of 7,829 citizens of the city of Quincy, Mass., praying that the battle cruiser Lexingon, now under construction at the Fore River yard be converted into one of the two aeroplane carriers authorized unduer the naval treaty, which were referred to the Committee on Naval Affairs.

House—Second Deficiency Appropriation Bill. An amendment to provide $150,000 for helium experimentation and production cost.

Mr. Hicks: a bill (H. R. 10712) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

Mr. Kelly of Penn.: a bill (H. R. 10717) to encourage commercial aviation and authorizing the Postmaster General to construct planes for air mail service; to the Committee on Post Offices and Post Roads.

March 6. *House*—Mr. Hicks: a bill (H. R. 10742) to authorize the conversion of battle cruisers into aeroplane carriers; to the Committee on Naval Affairs.

March 9. *House*—Conference report on H. R. 998 (Independent Office Appropriations Bill) advises Senate to recede from its disagreement to Amendment No. 26. This amendment carried an appropriation of $200,000 for the National Advisory Committee for Aeronautics and $10,000 for the construction of an additional laboratory building. This amendment has been agreed to by the House.

March 14. *House*—In submitting the Army Appropriation Bill H. R. 10871 the Committee cut the Appropriation of the Air Service to about $12,000,000. The Director of the Budget allowed $15,000,000. Of the $12,000,000, $6,000,000 is allowed for the purchase of planes, $400,000 for lighter than air and $400,000 for helium experimentation and production.

Later in the discussion Mr. Fitzgerald in speaking on this bill urges the need of more money for experimentation.

March 16. *Senate*—In discussing the Four Power Treaty, Mr. Reed introduces into the record the number of aircraft carriers of Great Britain, Japan and the United States with their speed, their armament and aircraft carrying capacity. United States has one; Great Britain 7; Japan 1.

March 17. *House*—A document by Rev. M. D. Shutter of Minneapolis on "The Army of the United States as a Constructive Force" was introduced into the record. In this document, he speaks of the extensive savings in timber by the use of the Forest Fire Patrol.

March 18. *Senate*—Appropriation of $1.900,000 allotted for the air mail service by the Senate.

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The AIRCRAFT TRADE REVIEW

Aerial Service Between San Francisco and Los Angeles Starts Daily Operation

With the delivery of two Aeromarinc Navy HS flying boats to the Western Airway Company of San Francisco, began a new era in aerial transportation on the Pacific Coast. Announcement of this new aerial scrvice was made today by C. F. Redden, President of the Aeromarine Engineering and Sales Company who have recently sold these two boats to the Western Airway Company.

A regular passenger and freight air service between San Francisco and Los Angeles is already in daily operation. One of these flying boats leaves San Francisco at 8:30 in the morning and another leaves Los Angeles at thc same time. The fare for the total distance is $50 per passenger.

O. L. Gagg, Pacific Coast Representative for the Aeromarine Company, stated recently that with the first of these Aeromarine Navy boats already in operation it would not be long before a large fleet of these. same type boats would be winging their way between California cities.

With the opening of the flying season, sales of the Aeromarine Navy HS flying boats are becoming frequent. The Easter Airways, Inc., of Baltimore, Maryland, who recently purchased two additional Aeromarine Navy HS flying boats have started one of these boats on a long commercial flight under the direct charge of the President, Mr. P. E. Easter.

The first boat is now in Florida enroute to New Orleans.

"Wherever there is a large body of water in the United States, Aeromarine boats have flown," said Mr. Redden. "Their distinctive white wings and hull have become a familiar sight to thousands of people and are establishing in the minds of the general public the fact that aerial transportation properly conducted is absolutely safe. We ae more than gratified to see the interest taken on the Pacific Coast in Aeromarine boats, and expect as rapid devlopments out there as we have seen in the East and Florida."

Loening in New Building

The Loening Aeronautical Engineering Corporation is now established in its new and specially equipped factory at Thirty-first Street and East Rivcr, New York City.

National Aircraft Underwriters Moves

The offices of the National Aircraft Underwriters' Association, formerly at 15 Park Row, New York City, are now at 120 West 42d St.

Hungesser Uses Farman

Capt. Nungesser, next to Fonk, the greatest of French Aces of the World War, with a total of over 70 official victories, has entered his order for a "Farman" two seater Touring Plane to be delivered to him on April 13th. Capt. Nungesser expects to make an aerial tour of Europe in the interests of commercial aviation.

Aeromarine News

New York, March 24, 1922—The disappearance and loss of a passenger carrying seaplane between Florida and Bimini is attributed to the lack of a Fedcral law enforcing the inspection of aircraft, according to Charles F. Redden, president of Aeromarine Airways, of New York and Key West, which to-day ordered to sea five flying boats and their surface acroplane mother ship to aid in the search for the missing craft. Mr. Redden sent the following telegram to the Chairman of the House Committee on Interstate and Foreign Commerce, which has now before it the Wadsworth Bill, providing for the regulation of aerial traffic:

"The seaplane which is reported missing off the Florida coast, with five passengers aboard, has attracted wide comment illustrating the peril of flight. This seaplane does not belong to the Aeromarine Airways fleet and should not be identified with our operations between Key West and Havana. Flying is just as safe to-day as travelling by rail, when rigid inspection of equipment is provided, eithcr by private organization or by public authority. The fact that we have transported thousands of passengers from the mainland to Cuba without injury or loss of life, is explained by rigorous requirements and extensive facilities. These, however, are the exception in much of the general flying that is now going on. Aircraft four and five years old, never properly overhauled or maintained, operate over territory which, under conditions, invite disaster. When a mishap occurs, legitimate aviation gets the blame. Such accidents will multiply with increasing loss of life and to the consequent detriment to aerial transportation, unless Congress passes, without delay, the Wadsworth Bill providing for inspection of machines and licensing of pilots and establishing a Bureau of Commercial Aeronautics in the Department of Commerce."

LIFE INSURANCE AND AERONAUTICS

By R. R. BLYTHE

THE Commercial Aircraft Companies have in the past often brought up the question about the validity of the life insurance policies applying to the passengers in case of death caused by the participation in aerial flight.

A life insurance policy is a contract issued by a company or corporation to a person to indemnify the beneficiary or beneficiaries in case of death.

Since a life insurance policy is a life contract between the company and the assured, it is important that the company (and therefor directly or indirectly the policy-holders) know whether the applicant is engaged in an occupation or profession which is extra hazardous or whether the physical conditions of the applicant are normal, in order that the ordinary span of life may be expected.

If this information is correctly given and accepted by the company, in most cases the policy is incontestable for any cause whatsoever after having been in force one or two years, depending on the company; with the exception of thc fraternal orders, who do not have any uniform rules in this connection. To quote the actual wording from one of these life insurance contracts, it states that "there are no restrictions under this policy while in full force of travel, residence, occupation or military or naval service." This would also include aeroplane flights as passenger or otherwise.

In the New York *Times,* Sunday, March 26, the following item appeared: "The Larabee Flour Mills Corporation will collect $200,000 as the result of the death of August Bulte, who perished in the seaplane Miss Miami."

Three officials of the same corporation in November, 1919, applied for life insurance of $600,000, the policies payable to the corporation. The applications for insurance of $200,000 each were from Frank Larabee, Fred D. Larabee and August Bulte. Policies were issued to Mr. Bulte and Fred Larabee, but the application of Frank Larabee was held up.

The next March Fred Larabee died and his company was paid $200,000. He had paid one premium.

Frank Larabee reapplied for insurance in September, 1920, and obtained a $100,000 policy. He died in June, 1921, after paying one premium, and $100,000 was paid to his company.

The policy issued on the life of August Bulte in November, 1919, has drawn three premiums to date. Through corporation insurance of its officials the Larabee mills will have collected one-half million dollars in two years. The total premiums paid was about $17,000.

It is usual in most life insurance companies to issue what is known as a "double indemnity" coverage at the approximate rate of $1.00 extra premium for each $1,000 in the amount of the policy. This double indemnity stipulates that in case of accidental death of the person therein insured double the amount of the policy shall be paid to the beneficiary or beneficiaries.

There is a clause in reference to this article which reads somewhat as follows: "The double indemnity feature of this policy does not cover during military or naval service of any kind in time of war or by engaging as a passenger or otherwise in submarine or acronautic expedition."

It may be, therefore, stated that in most cases where life insurance has been issued without question and is in force one or two years, as per stipulated incontestable period in the contract, that any claim arising from death suffered from participating in aeronautics is not contestable by the life insurance companies.

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THE PROGRESS OF RESEARCH

By Brig. Gen. R. K. BAGNALL-WILD, C. M. G., C. B. E., F. R. A. E. S.

Director of Research in the British Air Ministry

(Concluded from page 79).

Navigation

The most difficult of all problems in connection with "Navigation" is the provision of means in foggy or misty weather to enable an aircraft to locate the aerodrome for which it is bound and to make a successful landing to it. Unquestionably it is this difficulty which causes pilots on long routes to prefer to fly under, rather than over, clouds. Professor Jones, in a paper read not long since before the Royal Aeronautical Society, gave many reasons why it would be better for such flights to be made above the cloud layer, but ample experience before then and since has shown that it is no use to expect pilots to do this until their minds are reassured as to the adequacy and reliability of the ground organization enabling them to make safe landings through fog.

As one of the Committees of the main Aeronautical Research Committee, Professor Lindermann suggested that the best means of landing in a fog might well prove to be the provision by the aerodrome so afflicted of two pairs of small kite balloons floating above the cloud layer, the first pair being at such an altitude as would enable a gliding machine, which passed between them, also to glide between the second, and lower, pair, and after an equal interval of time to land on the aerodrome.

In the case of thin fogs or ordinary mists it may be that the specially bright red ground-flares which are now being tried will suffice. In heavy fogs there is always the possibility, given the right ground organization, of detecting the position of an aeroplane by sound and of signalling to it by wireless when to glide down and in what direction. This has been done successfully at Croydon.

Suggestions have been made to get rid of the fog either by mechanical means of pumping, or alternatively by electrical discharges, or even by burning vast quantities of coal or other fuel in order to warm the air above the saturation point; these three methods could easily he tried on a small scale and would doubtless work; when, however, they are figured out for an aerodrome of normal size the cost of their introduction is found to be prohibitive.

When in 1912 use was made of the precessional movement of a gyrostat to measure the velocity of roll on one of His Majesty's ships, it was not contemplated that by far the most successful application of the apparatus would prove to be for air travel; it is known as the gyro turning indicator, and ample experience has shown that it is more sensitive and much more rapid in its indications than any other method that has been trip for indicating the turns of an aeroplane. Unlike the use of a constant azimuth gyro, this apparatus does not need to be delicately balanced as regards the position of its center of gravity, and is therefore remarkably fool-proof. Aeroplanes flying in a fog frequently get into turns without knowing it, and when they do so, the magnetic compass, particularly when of an old pattern, is pretty sure to indicate a turn in the wrong direction, and so thoroughly mislead the pilot.

Modern compasses are much less affected than were their predecessors by the yawing oscillations of an aeroplane or even by moderately rapid turns off North, and this is due in the first instance to the work of Keith Lucas and Lindemann when at th Royal Aircraft Establishment, and later by the work of Dr. Bennett of Emmanuel College, Cambridge, and the late Lieut.-Commander Colin Campbell of the Admiralty Compass Observatory. The Farnborough work showed the advantage gained by a long period, whilst the later inventors pointed out the great advantage of damping the oscillations of the magnetic needles even to the point of aperiodicity.

It is a natural speculation as to what is likely to be the amount of deviation error in the magnetic compass when machines are built entirely of steel. Such tests as have already been made are, however, reassuring in this respect. It seems that the deviation error in any machine is largely dependent on the proximity of the engine, and that this effect predominates whether the framework is construeted of wood or of steel.

As regards navigation, either when flying over the sea out of sight of land, or when flying at any time above clouds, the necessary instruments to enable the position to be determined by the methods of nautical astronomy are now availahle. They have become sufficiently developed to enable the position to be obtained with a probable error not over ten miles. This is as high a standard of accuracy as is necessary for ordinary air work: it enables a check to be made on the Dead Reckoning course, and upon any determinations of positions derived from wireless methods.

The study of Directional Wireless is being steadily pressed forward. A particularly promising form of it is the rotating wireless beacon; this method offers the very considerable bait of freedom from the troublesome quadrantal error, but it, like other wireless methods, depends for its ultimate accuracy on a careful study of the conditions which determine the nature of the path followed by the waves.

Machines

The question of stability is being continuously studied, and I hope in the future that it will prove possible so to organize the work as to give more time to this important subject. If possible, one of the National Physical Laboratory wind channels should be allocated entirely to this work.

Stability may be either inherent or automatic. Automatic stability is attained through the operation of some more or less complicated auxiliary mechanism, whilst inherent stability is stability due directly to the nature of the design of the aerodynamic surfaces, the disposition of weights, etc. If inherent stability can be attained there will be small need for automatic stability. At present the problem of longitudinal stability is to a large extent solved, but that of lateral stability still requires a great deal of work to be done upon it. Much has also to be done on the measurement of pressure distribution over wing surfaces; I hope that in the future it will be possible to give more time to this subject.

Not a little public attention has been drawn to the interesting arrangement of slotted wings proposed by Mr. Handley Page. A large Handley Page monoplane wing with a single long slot is now at Farnborough awaiting test. This wing also has short slots in front of each aileron. Two other new Handley Page designs are also in hand. The results will be followed with great interest. The earlier trials have shown very remarkable results. A D.H.9 aeroplane, fitted with a Puma engine, was found when equipped with a Handley Page wing to have both greater aerodynamic efficiency and greater climbing capacity than when fitted with the standard wing. The climbing slope in the one case was 1 in 7.2, and in the other 1 in 10.4. This is an important consideration when clearing obstacles around an aerodrome. Moreover, for getting off and on to decks, it was found that the launching run witb the Handley Page wing was less than half that necessary with the standard wing under similar conditions. Public attention has also been drawn to the "Alula" wing, and careful tests have been made of models in the wind channel; these have not so far demonstrated that a wing made in this fashion should be exceptionally good, but it is conceivable that the scale effect between a model and a full size may be unusual in a wing of this shape. The point is being looked into.

As regards propellers there is no doubt, as has been pointed out by my predecessor, that a complete metal propeller would he a great boon. I would even go so far as to say that for all Service aeroplanes in the East tbey ar essential, even at the cost of a greater propeller weight. For sizes of over 450 hp. there is reason to hope that the increase in weight will not exceed 10 per cent.

Now that the supercharging of aero engines has been shown to be a possibility, it is necessary, in order to take full advantage of it, to provide a variable pitch propeller; these will also almost certainly have to be of metal. Work is therefore in hand in this direction at Farnborough, and I trust that it will be found possible to do all that is necessary without a disadvantageous increase in weight or complexity.

The ability to fly off or land on the deck of a ship is becoming increasingly necessary. Development work to this end is in hand, and I hope the future will show that amphibians as well as aeroplanes will he easily capable of being used for this purpose. It is very necessary that they should, since descents onto water cannot always be avoided. and "landings" of this kind with aeroplanes are liable to be expensive. Experiments are in hand to examine into the sea-keeping abilities of the large N.4 flying boats. These weigh some 30,000 lbs. and have engines giving a total of 2,600 hp. It is hoped they will prove themselves good sea going craft.

And what of the helicopter? It is difficult to know what to say. Efforts are proceeding and public money is being spent; we shall, I hope, be rewarded for our foresight. Mr. Brennan's helicopter has flown to tbe extent of lifting the

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pilot and 250 lbs. useful load—an encouraging preliminary flight.

Much public attention has beeen drawn to the tests made this winter on different types of fuel tank proposed by various designers. As is generally known these tests were made by inflicting on the tanks submitted a destruction experiment analogous to that of a heavy crash.

The difficulties in regard to the construction of fuel tanks were brought home during the War. It was soon found that the use of a suitable rubber envelope would prevent petrol from leaking from a small bullet hole, but the problem to be solved was a much more difficult one than this. If an empty fuel tank were fired at, a small hole would be made in the metal wall at entry and another at exit. If this, however, were done with a full tank the size of the hole at entry would not be changed, but the exit hole would be enormously increased in size, sometimes amounting to the blowing out of the far side of the tank. The latter effect was no doubt due to impulsive pressure in the liquid, but the right steps to take in order to minimize its effect were not so easily apparent. As is now generally known something very close to a solution was found in the introduction of a very thin walled tank coated on the outside with rubber and known as the Imber tank; it was, however, somewhat heavy, and was not considered to be entirely satisfactory as a fuel container under the conditions of a crash. When a tank full of petrol crashes there is initiated in the mass of the liquid an intense impulsive pressure not very dissimilar to that which is created when a high velocity projectile is suddenly brought to rest in the first few inches of the penetration of the liquid mass. To test the Imber tank, two Sopwith Camel aeroplanes were fitted with main and gravity tanks of this pattern and dropped, with engines going, from Airship R.33. The intent was to stimulate a spinning nose-dive crash with engines running and all possible causes of fire on impact free to operate. In the first test the main tank was burst by the impulsive pressure and a mad spray of petrol hot up; the gravity tank did not suffer so badly. In the second test the engine did not open out fully and the crash was less severe; both tanks survived and there was no spray or leakage of petrol. In neither case was there a fire.

Materials

The work of the Materials Sub-Committee of the Aeronautical Research Committee has led to the undertaking of researches of very great importance, not only for the future of aircraft construction, but for the engineering industry generally. On the latter, however, this is not the place to dilate. The special need in aircraft construction which differs from previous engineering experience is the enforced weight limit. The long confirmed custom of measuring the tensile strength of a material and then dividing this by some "factor of safety" of 5, 6 or 7 is inapplicable to aircraft since the resulting structure would be far too massive. In aircraft, perforce, finer limits have to be worked to and this renders it essential that the logical basis of design should be closely examined. The result of this scrutiny is to show the need to think rather of fatigue limits than of ultimate stress limits. The great difference betwen these two methods is seen in the effect of a tool mark or scratch on say a crank-shaft. Under a steady stress, local yielding would quickly absorb the minute area of high stress, but under an alternating stress the sensitive area is pulled to and fro until an appreciable portion of the shaft is weakened, and breakage results. A study of these matters is bringing forward new methods of testing, and it has, moreover, thrown light on that "scientific puzzle," the spiral fracture of a shaft. Work at Farnborough has shown the ideal limits for tensile strength and with certain substances this limit has, temporarily, been very nearly attained. I need not dilate on the immense importance of these possibilities to all engineering work, and to that of aircraft especially.

Tests on the fatigue of the materials used on aircraft are being carried out at more than one center. Investigations on this, or allied subjects, are being undertaken at the Universities at Leeds, Edinburgh, Bristol and Birmingham, in addition to researches at the National Physical Laboratory and elsewhere.

Perhaps the most troublesome material in present-day aircraft is the rubber tubing used for conveying petrol. It has to be of the "P.R." or "petrol resisting" quality, and it seems unfortunately to be the case that the effective life of this rubber is but six months, so that by the time it has been shipped to a distant Air Force center and been passed into store for a moderate time, a large proportion of its effective life—and sometimes the whole of it—has vanished. To avoid this serious difficulty the Royal Aircraft Establishment has fitted machines with piping of copper; but it is unfortunately much more difficult to fit stiff pipes than flexible ones. Happily, however, the "petroflex" piping devised by Mr. Blaisdell affords a very useful means of avoiding both the rapid aging of the rubber and the stiffness of the copper. Petroflex in rather a wonderful material. It is made up of some ten layers, glued together, of the intestines of Chinese hogs, of which, fortunately, there seem to be illimitable numbers. Around these are layers of canvas, fire-proofed. Outside this in turn, as a final protection, is a spiral of metal wire (aluminium in the case of land machines). This tubing appears to be totally unaffected by petrol, though care has to be taken to keep water away from its inside. Experiments have shown that the piping will stand as much as 200 lb. per square inch of internal pressure. Fifty sets have been sent out to the East for trial.

A supply of the right quality of timber for building aircraft is one of the most serious responsibilities to those in charge of such matters. It has been of especial importance in the last few years owing to the world demand for timber of all kinds, and the consequent indisposition of markets to take great trouble in sorting the timber or in drying it. This bears particularly hard on aeroplane construction, and I am therefore very glad to find that Canada is no supplying spruce so carefully selected that it seems not unlikely that over eighty per cent will be found to comply with our best quality specifications. There are therefore great possibilities in this direction.

An interesting development is the introduction of non-magnetic steels for those parts of aircraft which are in the immediate neighborhood of magnetic compasses. The use of stainless steel or stainless iron has also many possible applications.

Sixth Corps Aero Plans

Plans for class room instruction for officers desiring to take the examinations for promotion in the Reserve Corps were laid March 25 at a meeting of the Air Service Officers' Association of the Sixth Corps Area. The meeting was held in the Army and Navy Club, Chicago. Major William C. McChord, Air Officer of the Sixth Corps. Area, and Lt.-Col. Morris N. Keck, engaged in the organization of the reserves in this area, gave short talks on what had already been accomplished in the way of organization and the plans for the future.

According to these officers, the fundamental basis for promotion in the reserves will be that of inherent ability, rather than promotion on the basis of seniority, as in the regular army, where, it was added, conditions were somewhat different and that promotion by seniority seemed to be the most practical method.

"I do not anticipate that the technical and general examinations which candidates for promotion will be called upon to pass will be very severe," said Major McChord. "Great weight, however, will probably be given to the candidate's demonstrated ability in civil life, his past record in the service and the extent of his present interest in the work of the organized reserves. All these things will be taken into consideration in connection with the examining board's estimate of his value to the reserves in the particular rank and branch of the service for which he is taking the examination. There are many vacancies in the grades of 1st lieutenants, captains, and higher grades which must ultimately be filled, and we are bending every effort to pick men competent to fill them. It is a painstaking and difficult task. Let me repeat that, other qualifications being equal in considering candidates for vacancies, evidence of continued and sustained interest in the difficult period that the reserve is now going through will undoubtedly carry weight with the examining boards."

First Lieut. Kenneth T. Price of the reserves gave a rèsumé of the probable line of question in the examination on Military Law. His talk will be followed from time to time by other members of the reserve, leading discussions of other subjects the examinations are scheduled to cover. Capt. P. G. Kemp, A. S. O. R. C., chairman of the association, presided at the meeting. Other reserve officers present were: Lts. Joseph P. Dunne, Homer S. Watt, Herman H. Woeltjen, William E. Bausch, Arthur H. Stanton, J. W. Schroeder, Henry T. Hemmingway, E. G. Tuttle, R. E. Ailsworth, Leo L. Leonard, C. G. Geisler, S. J. Bovey, Raymond R. Rehm, Keith Jones, Otto Grafe, Roger F. Howe, J. C. Keogh, R. C. Kuhn, M. D. Harbula and Dallas M. Speer.

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THE THEORY OF THE SCREW PROPELLER*

By A. BETZ, GÖTTINGEN

THE reason why the comprehension of what occurs in the vicinity of a propeller is commonly regarded as especially difficult, does not lies so much in the complexity of the hydrodynamical phenomena as is our limited ability of geometrical presentation, which some times fails us, even in simple cases, when these have a spiral form. The mathematical treatment is rendered still more difficult by problems connected with the propeller symmetry. Aside from the above inconveniences, which are not inherent in the nature of the phenomena, the propeller offers no greater difficulties than the majority of other hydrodynamic problems. By confining ourselves to the most essential phenomena, we can represent them in a very simple fashion. It is characteristic of this simplicity that we have long had a presentation of the theory of the propeller in Rankine's propeller slip-stream theory, which is a fairly close approximation to the truth and which may be regarded as a sort of forerunner of the modern theory† of aerofoils. Only when we endeavor to acquire a more accurate knowledge of the phenomena, will the theoretical treatment become more difficult. Our knowledge is most deficient in regard to the mutual action of propeller and airplane. In this connection, we must depend almost entirely on experiments. The cause of this ignorance resides less, however, in the propeller than in the resistance of the aeroplane, which here plays a very important role. This problem of the resistance of a body moving in a fluid and the attendant loss of energy, aside from any special cases, bas thus far withstood all theoretical treatment and has had to be worked out almost exclusively by means of experiments. It is therefore natural that our imperfect knowledge of the phenomena which determine the resistance of the aircraft also hinders the theoretical treatment of the related propeller phenomena. The problems relating to the independent operation of the propeller are, on the contrary, with the exception of a few very special problems, mostly solved, at least as regards propellers with favorable shapes, which alone are of any practical importance. This limitation has the advantage of enabling us to assume as small the loss of energy from friction and the formation of fortices, over which we have the least control, as compared with the amount of energy otherwise lost, and the further special advantage that the large number of shapes which otherwise would have to be considered is thereby greatly reduced. The following exposition will consist of a brief review first of the fundamental development through later researches, which demonstrate the connection between the propeller slip-stream theory and Froude's so-called "propeller blade theory."‡

If we wish to exert a force on a body, for example, on a vehicle to overcome the head resistance, we must use some other body as a brace and exert upon it the same force, but in the opposite direction (law of action and reaction). In a moving vehicle on the solid earth, the latter is nearly always the resisting body, which, cn account of its large mass, suffers no noticeable change in speed from the reaction. The case is different, if we utilize a relatively small body which is not rigidiy connected with the earth. In such a case, the body is affected by the force of reaction and acquires a noticeable velocity. This phenomenon is very apparent in firing a cannon ball. We wish to impart a velocity to the ball and therefore a force must be exertcd upon it. The cannon is the resisting body and is given a velocity in the opposite direction to that of the cannon ball (recoil). The case is similar if we wish to set in motion a body in a fluid (air or water) by means of a propeller. We may thing of the process as follows: A mass m of the fluid is utilized for a second as the reacting body and acquires a certain velocity v. Then another equal mass of fluid is brought into play and serves as the reacting body for the next second, etc., so that in each second a mass m acquires an increase in velocity v. If S represents the propeller thrust, the force of reaction must have the same value and the acceleration v, imparted to the mass m in one second by the action of this force, is $v = S/m$.

It is not essential for us to think of the process as being divided into intervals of one second. If we represent each interval by I/nth of a second and take the corresponding 1/nth part of the mass, we obtain for the same reaction force, the same velocity and the mass accelerated *per second* remains the same. The velocity imparted to the reacting fluid is directly proportional to the thrust and inversely proportional to the mass of fluid acted upon per second. With this velocity, the fluid acquires an increase in energy amounting to $\frac{1}{2} m v^2$ per second. This energy must be supplied in addition to the useful power in order to obtain the desired thrust. It means, however, an unavoidable loss of energy.

If all other losses are disregarded, it follows from an extension of the above reasoning that the most favorable case is when the thrust is evenly distributed over the whole surface of the propeller blades. This condition would be approximately fulfilled by a propeller with very many blades. The theorems for the losses in the propeller slip stream obtained from this very simple theory are very useful for estimatign the efficiency of a propeller, since the remaining losses are ordinarily considerably smaller and not so dependent on external conditions.

The theory also gives the velocity with which the fluid passes through the plane of the propeller. It may be shown that the fluid passing through the propeller acquires half its acceleration in front of the propeller and the other half behind it. An accurate knowledge of the flow at the plane of the propeller is however much desired, since it will give us a basis for calculating the blades and the position to be given them in order to obtain the desired thrust. For this purpose, however, the results of this primitive theory are no longer entirely adequate. So long as but little was known concerning the action of the fluid on the propeller blade, there was no great need of a more accurate knowledge of the flow in the plane of the propeller. But after the investigation of the phenomena of aerofoils had laid in this respect the foundation for a more accurate calculation of the propeller blade, it was alsp desirable to increase the knowledge of the flow in the vicinity of the propeller.

There were in the main two points requiring further elucidation. In the first place, the propeller, in addition to the motion of the slip stream parallel to its axis associated with the thrust, also generates tangential motions which necessitate a slight correction to the considerations of energy and, what is more important, produce a noticeable increase in the flow through the propeller disk. In the second place, screw propellers always have had a very limited number of blades. It was therefore desirable to determine what difference this circumstance makes in comparison with the assumption of a large number of uniformly distributed narrow blades. In both directions considerable progress has recently been made. Although some points have not yet been worked out for convenient practical application, the principal difficulties have nevertheless been overcome.

The investigation of the rotation of the propeller slip stream is closely connected with the above-mentioned considerations of the simple older theory. Simply, the propeller torque is substituted for the thrust. The connection between the individual quantities is indeed considerably more complex in this extended propeller slip-stream theory than in the older theory, and the calculations are more difficult. But after the requisite laborious calculations have once been made, the results can be expressed in the form of curves, which can serve as the basis for practical applications.*

The second point, in which the old propeller slip-stream theory needed to be supplemented, was the assumption that the thrust could be distributed at will over the surface of the propeller disk, which holds true to a certain degree for a propeller with very many narrow blades, but certainly not for an aeroplane propeller with two blades which cover only a very small portion of the propeller disk. It may however be here noted that the difference in comparison with the uniform distribution is not so great as appears at the first glance. On account of the revolution of the propeller, its blades exert a pressure at every point of the propeller disk, only not simultaneously and continuously, but periodically, always again at another place.

For the treatment of this propeller with widely separated blades, there is a very useful method which was developed principally in connection with the theory of aerofoils and has already been very successfully applied in that connection (Compare the article, Betz, "Einführung in die Theorie der Flugzeug-Tragflügel," Die Naturwissenschaften, Vol. 6, p. 557). A field of well-defined vortices is connected with the distribu-

* Reprint from "Die Naturwissenschaften," 1921, No. 18.

† Rankine, "On the Mechanical Principles of the Action of Propellers." Transactions of the Institution of Naval Architects, 1865, Vol. VI, p. 13. The theory was considerably improved later, especially by Froude. Froude, "On the Part Played in Propulsion by Differences of Fluid Pressure." Transactions of the Institution of Naval Architects, 1889, Vol. XXX, p. 390.

‡ Froude, "On the Elementary Relation between Pitch, Slip and Propulsive Efficiency." Transactions of the Institution of Naval Architects, 1878, Vol. XIX, p. 47.

* Betz, Eine Erweiterung der Schraubenstrahltheorie, Zeitschrift für Flugtechnik und Motorlufttschiffahrt, 1920, Vol. CI, p. 105.

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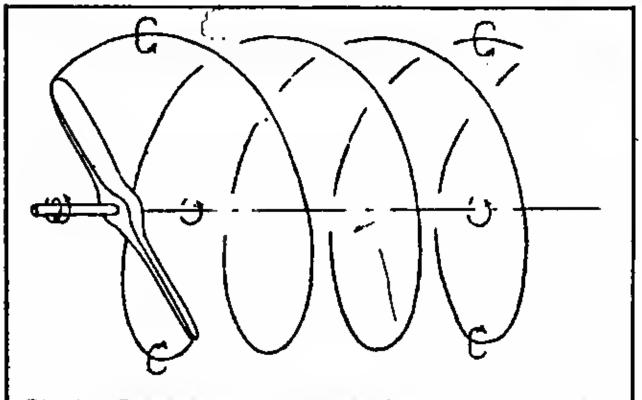

Fig. 1 - The system of the most important vortices behind a screw propeller.

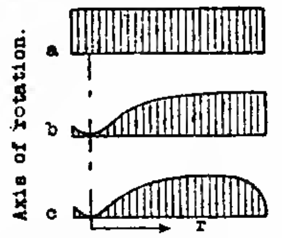

Fig. 2 - Most favorable thrust distribution over the propeller disk:
a) according to the simple propeller slip-stream theory;
b) considering rotation of slip-stream;
c) considering finite number of propeller blades.

tion of the propeller thrust, or the lift of a wing. Since, on the other hand, the motion of the fluid is definitely determined by the vortices existing in it, we can calculate the flow from the thrust distribution by means of this concept of vortices.

Such a calculation, however, consumes considerable time. An effort has been made, therefore to simplify this work. Föttinger gave a practically applicable method in his lecture before the Society of Naval Engineers (Schiffbautechnische Gesellschaft) in 1917.* He proceeded from the correct concept that the strongest vortices are restricted to definite regions, so that we can represent them approximately by single vortex lines. These lines are the propeller axis and the spiral lines going out from the tips of the propeller blades and encircling the propeler axis (Fig. 1)).

As in the theory of aerofoils, in which a corresponding approximation is employed, this simple vortex picture always performs very good service, when the flow is investigated at some distance from the vortex lines. That the picture of the flow in the vicinity of the individual vortex lines can no longer agree with reality follows from the fact that the theoretical velocity in the immediate neighborhood of an indefinitely thin vortex line is infinitely large. If we wish to investigate the flow in the vicinity of the vortex field, more especially, for example, at the place where the blade itself is, we must have as a basis more accurate data on the distribution of the vortices, that is, on the distribution of the thrust along the blade.

After it had been demonstrated by the theory of aerofoils (in which the same difficulties occur, though to a lesser degree) that the most favorable lift distribution gave very simple flow relations, the idea suggested itself to investigate as to whether, for the propeller also, the most favorable thrust distribution is not characterized by very simple flow relations. As a matter of fact, perfectly analogous laws for the propeller can be derived by proper modifications of those employed for aerofoils.†

The most important one of these laws reads: The flow behind a propeller which has the least loss of energy agrees with the ideal flow about rigid screw surfaces displaced axially backwards. The shape of these screw surfaces is that which is cut in the fluid by the propeller blades in their motion. The speed of the displacement depends on the magnitude of the thrust.

* Föttinger, Neue Grundlagen für die theoretische und experimentelle Behandlung des Propellerproblems, Jahrbuch der Schiffbautechnischen Gesellschaft, 1918, Vol. 19, p. 385.

† A. Betz, Schraubenpropeller mit geringstem Energieverlust, with an appendix by L. Prandtl, Nachrichten der Gesellschaft der Wissenschaften zu Göttingen, Math. physik. Kl. 1919, p. 193.

However simple this statement concerning the flow generated by a propeller with the most favorable thrust distribution may appear, the problem is nevertheless not entirely solved by it. The mathematical treatment of the flow about such a displaced screw-surface presents very great difficulties. Prandtl has given an approximate solution of this problem in an appendix to the writer's article mentioned in the footnote. Though this solution does not give entirely accurate values, especially for the two-bladed propeller, it is perfectly satisfactory however for practical purposes.

Fig. 2 represents the most favorable thrust distribution, as determined by the old propeller slip-stream theory and also by the later improvements of the same. The thrust per unit surface is represented for the different distances r from the axis of the propeller. In case c, the thrust, which is here concentrated on the blade, is to be thought of as uniformly distributed on the circumferences belonging to the corresponding radii. In the old propeller slip-stream theory, the thrust is evenly distributed over the whole surface. With the consideration of the slip-stream rotation, we obtain a pressure drop at the axis and, with the consideration of the finite number of blades, we obtain also a pressure drop at the blade tips.

In deducing the laws of the screw propeller with the most favorable thrust distribution in the case of a finite number of blades, it has been assumed that the thrust is so small that the flow velocities generated by the propeller can be regarded as small in comparison with the proper motion of the propeller. We can, however, by foregoing strict mathematical accuracy, but without any error worth mentioning, so modify the laws that they will also hold good for more heavily loaded propellers.

In all the preceding discussion it has been taken for granted that we possess in the propeller blades a suitable device for exerting forces on the air, which will produce the desired thrust. No knowledge has been gained however as to the necessary shape of the blades for obtaining the desired effect nor as to the loss of energy due to the production of pressure by the blades. These data may be supplied by a method entirely different from the preceding. Its principles were expounded by Froude in 1877. Both theories, the propeller slip-stream theory and the propeller blade theory, long existed side by side, without our being able to give an entirely satisfactory explanation of the real connection between them. Knowledge of the phenomena in the vicinity of aerofoils, and more especially of the influence of the span on the resistance, first shed light on the corresponding phenomena in the vicinity of propellers.

If we assume that the effects of the individual parts of the blade, in its motion through the field, are independent of each other, we only need to determine experimentally, once for all, the forces arising in connection with the motion of definite cross sections, in order to calculate from them the forces acting at every point of the blade. The magnitude and direction of the velocity of the particular portion of the blade is indeed given by the two components, the circumferential and the forward motion. From the forces acting on the individual portions of the blade, the thrust and torque of the whole propeller can then be readily calculated. In practice, this method has the important advantage of giving the relation between the thrust and the torque, on the one hand, and the shape of the blade, on the other. Unfortunately, the assumption that the individual parts of the blade do not interfere with each other in their effect, is not correct. In practice, we may, to a certain extent, avoid this difficulty by taking as the basis of the calculation for each propeller type, somewhat different section characteristics, so selected that the resulting values for the whole propeller agree with the experimental values.

The propeller slip-stream theory, especially in its improved form, now gives us the basis for determining the mutual influence of the parts of the blade, so that, in calculating the shape of the blade, we can get along with certain section characteristics, which have been determined once for all. As we have already seen, the fluid has acquired a certain added velocity in passing through the propeller disk. Consequently the motion of the blade section relative to the fluid is dependent not only on the forward and circumferential speed, but also on this proper velocity of the fluid. In this acquired velocity, expression is, however, found for the whole influence exerted by the remaining parts of the propeller on the effect of an individual section. The connection between the acquired velocity and the section characteristics is especially manifest if we compare the loss of energy, as given by the propeller slip-stream theory, with the loss appearing at the blade in consequence of this added velocity. When we thus combine the propeller slip-stream and propeller-blade theories, we obtain a complete theory, corresponding well with facts, of the screw propeller operated by itself. The propeller slip-stream theory gives the action of an ideal propeller which, among other things, forms the basis for the correct application of the propeller-blade theory. The latter clears up the additional phenomena which depend on the special properties of the blades and more especially the magnitude of the losses at the propeller blade, not considered in the propeller slip-stream theory.

It is intended to show, by the above explanations, that the new theories present the possibility of investigating the phenomena in the vicinity of a propeller, so as to be able to calculate its action on the basis of fewer experimental values. As already mentioned, there is still much work to be done in reducing the methods to a convenient form for practical application. There is also much still to be investigated experimentally. Aside from all questions concerning the mutual effect of propeller and aeroplane, there are the characteristics of the blade sections, which still require thorough investigation. Although we have very accurate values for aeroplane wings, it is still uncertain whether these values can in all cases be applied in their present form to propellers. The centrifugal force of the revolving propeller may well cause deviations. Furthermore, at high velocities, the compressibility of air, as likewise the so-called cavitation in water, plays a certain role. There is still, therefore, in spite of all theoretical progress, a rich field for experimental activity in connection with the screw propeller.

(Translated by the National Advisory Committee for Aeronautics.)

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COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

(*Continued from page 3*)

ITALY

In Italy, unlike the other countries we have discussed so far, the Government has taken a surprisingly limited interest in the development of civil aviation, whereas after the war, in other countries, the Governments have done all that was possible in order to encourage the establishment of aerial lines and in keeping alive the aircraft manufacturing industry. In Italy, due to either or both the lack of funds in the budget to devote to aeronautics and the lack of a well defined program in aeronautics, we find that since the war the burden of keeping alive aeronautics in Italy has been thrown entirely on the shoulders of aircraft manufacturers. Under the circumstances, it is rather remarkable what has been done by them in the last two and one-half years, with practically no orders from the Government and thrown on their own resources for finding markets for their products.

Aircraft manufacturers in Italy have been devoting all their efforts since the war in creating a demand for Italian aircrafts abroad, and the few good firms that are still in existence are finding that their efforts are meeting with a good success.

The skill of the Italian workers, the ability of Italian aeronautical engineers, which is of a high order of excellence, and the comparatively low cost of labor in Italy, due to the exchange situation, makes it easy for Italian aircraft manufacturers to sell their products abroad and to keep from disbanding at least the nucleus of their manufacturing and designing organization, which during the war was composed of almost 500,000 men.

The most important firms which are still in the market as aircraft manufacturers are: the Ansaldo, the Caproni, the Breda, the Fiat, the Macchi and the Savoia. The last two having particularly specialized in the design and construction of seaplanes and hydroplanes, which can compete with similar construction made by other nations, some of their types being distinctly superior to corresponding types built by other nations. These two firms are doing very good export business and are supplying hydroplanes to foreign navies besides the Italian Navy. The Ansaldo Company has built a number of aeroplanes for passenger service of a very good design and well adapted for such service. The Fiat Company has built the best wooden aeroplane for commercial purposs, whicch has been flown so far. This machine was designed and constructed by Rosateli, (one of the most genial aircraft designers), for making the flight across the Atlantic, which, however was never attempted. The Fiat Company has also designed two aeroplanes, one for six and the other for ten passengers and a three unit power plant with a single propeller. The Caproni firm has built last year, a Giant aeroplane for 100 passengers, which, however, during the trial test, was partially smashed up and is now being reconstructed.

Italy has always been very active in dirigible construction. The Italian dirigible (of which we have recently acquired a unit, the "Roma," now destroyed) is the semi-rigid type. Dirigibles of this type have been made at the "Royal Aircraft Establishment" in Rome, operated by the Italian Government directly, and dirigibles and balloons both for the Italian Government and foreign Governments have been made there. There is now under consideration by the Italian Government, a project for selling the "Royal Aircraft Establishment" to a civilian syndicate and let the syndicate take care of the construction of Italian dirigibles. It is anticipated that such a move, if the proposed project is approved, will give a more healthy life to the dirigible industry in Italy.

A number of aerial navigation companies have been started in Italy, but none of them has established and operated a regular service on some definite route. The activities of these companies have been mainly limited to advertising flying as a new means of transportation and to make flights with passengers upon request. Among the most active of the various companies, the S. A. I. A. M., during its first year of operation from June first, 1920, to May 31, 1921, made the following record:

	Hours of Flight	Passengers Carried
June 1920	96.45	365
July "	101.35	591
Aug. "	160.12	453
Sept. "	173.30	520
Oct. "	125.45	374
Nov. "	110.13	215
Dec. "		
Jan. 1921		
Feb. "	90.11	238
Mar. "	37.50	139
Apr. "	45.30	217
May "	56.40	240
Totals	998.11	3352

Another company, the S. A. C. T. A., is going to open up, next summer, the line between Genova-Porto Torres and Porto Torres-Cagliari, between the mainland and the Island of Sardegna.

A regular aerial service has been organized and it is operated by the Government in one of the Italian colonies in Africa between Tripoli and Hons, making one trip per week for carrying mail. The passenger service is limited only to Government officials and Government employees travelling in the service of the Government. The passenger service is effected with 450 H. P. Caproni machines and the mail service is effected with S. V. A. machines. This is only a short line, only 62 miles long, and a very small attempt to establish aerial mail service in Lybie.

No aerial mail service is in operation in Italy at the present time.

Contrary to what the French Government is doing in establishing hydroplane bases in the Mediterranean, very little is done in Italy in this direction, in spite of the fact that the geographical location of Italy in the middle of the Mediterranean, would make it extremely expedient to develop and to maintain a large number of hydroplane bases. The hydroplane port service is operated by the Italian Navy only. Only in Naples, Taranto and Brindisi, the service is well organized. In the hydroplane ports of Venice and San-Nicolas-Varano, the service is only partly organized. In the hydroplane ports of Livorno, Orbetello, Ostia, Syracuse, etc., the service is very poorly organized, lacking as they are in sufficient fuel and oil reservoirs and spare parts. What has been done very efficiently by the Government has been the organization of a very good aerological service for supplying aerial navigators with all the required data. The technical services are well organized and have a very good personnel, working at technical investigation and research work, but they are always struggling along with insufficient funds to carry on their work.

The Italian Admiralty has undertaken the installation of lights on the airdomes of San Remo, Spezia, Orbetello, Centocelle, Naples, Trapani, Catania, Taranto, Brindisi and Pola. These lights, however, are on only when so ordered by the command of civil aeronautics or the Admiralty.

In Italy, there is at the present time, quite a mess of civil, military and naval aviation with no well defined limits, and interfering with each other, thus handicapping any civilian initiative for establishing regular aerial services in Italy. The public press, the Aero Club and the Society of Aeronautical Engineers, have been lately conducting a quite lively campaign in order to have this tangle straightened out and for obtaining the establishment of a healthy civil aviation in Italy, and all indications are that in the course of the current year something will be done in that direction.

Italy, due to its geographical position in the middle of the Mediterranean is a very important jumping off point for the international lines plying between central Europe, the North African Continent, and the Balkans, and there is no doubt that as international aerial lines are established and developed, Italy will play a rather important part in the commercial aviation game, especially considering that the aircraft manufacturing industry thre is capable of producing good aircraft at a good price.

The aeronautical activities of Italy, so far, have been limited to a number of raids and competition in international aero-

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nautical events where the Italians have obtained a number of important prizes during the last two years.

GERMANY

We have seen so far that one of the reasons why commercial flying has not been a financial success in France, England, Belgium and Italy is that the aircraft used for commercial services were not adapted to the kind of service required of them. In almost any case of commercial exploitation by aerial lines in Europe, aeroplanes which were originally designed for war services were modified so as to allow for their being used as commercial carriers. This handicap, under which commercial aviation was born in Europe, is due to the enormous number of military aeroplanes left over when the war stopped.

The aircraft manufacturing industry has also been handicapped by the fact that aeroplanes were sold by the Governments from the stocks left over after the demobilization, at such a price that aircraft manufacturers could not compete with the Government in selling tbeir products.

In Germany, we find an entirely different condition prevailing after the war. The treaty of Versailles practically wiped out all aircraft existing in Germany at the time when the Armistice was signed. All the aeroplanes and flying equipment had to be handed over to the Allies so that Germany, right after the war found itself with no aeroplanes.

Two opposite tendencies were sbown in the supreme council regarding the future of aeronautics in Germany. French, Italian and Belgian experts were in favor of prohibiting to the central empire the construction and the use of flying machines (both aeroplanes and dirigbles) for an indefinite period of time, until such a date as the rest of the world might feel confident that the defeated nations had abandoned any projects of future aggression. This tendency was opposed by English and American delegates, wbo finally succeeded in carrying the point.

The decision arrived at was that military aeronautics had to be suppressed in Germany, that all the existing aeronautical material had to be either destroyed or handed over to the Allies, but at the same time it was agreed that commercial aeronautics could be born in Germany, although a number of limitations were imposed on the German aircraft manufacturing industry, which, however, inside of the next few months will be entirely removed, Germany having complied with the conditions imposed on them by the Treaty of Versailles.

Due to the situation brought about by the Peace Treaty, commercial aviation was born in Germany without the handicap of the existing large number of war aircrafts, which in the other countries made it difficult for the aircraft manufacturers to design and manufacture commercial aeroplanes well adapted for commercial use, when such large numbers of aeroplanes could be bought at an extremely low price from the Government and transformed in a more or less inefficient way to commercial use.

The consequences of the situation is that since the war, Germany has developed some exceptionally good commercial aeroplanes, and has built a fleet of such planes which are far superior to those used by the other nations. They are more efficient, and better adapted to commercial exploitation. They are so much so that the progress made by Germany in aeronautical construction is eliciting some uneasy feelings throughout the rest of Europe. On October 13th, of last year, in an editorial appearing in the London *Times*, some sanctions against further expansions of German aeronautical activities were invoked. It was pointed out in that editorial the very obvious fact that the technical progress made by the development of the aircraft manufacturing industry in Germany constituted a potential military danger for tbe future, considering the fact that a commercial aeroplane can, without much trouble, and in a very short time, be transformed from a commercial flying machine to a war engine. These conclusions are obvious and they are well in accordance with the opinions expressed hy the French, Italian and Belgian experts advocating the suppression of all aeronautical activities in Germany for an indefinite period of time. It is rather surprising that in some British quarters, anxiety should be voiced at the present time about the future of German commercial aviation, which is indebted for its very existence to the British and American stand taken in the Supreme Council.

Anyway, at the present time, nine strong and well organized aerial transport companies are in existence in Germany, and are making plans for future developments, which shall be particularly interesting in establishing communications between Germany, Sweden, Holland, the Balkan States and Russia. In Russia, especially, we might expect that the Germans will be in the future a dominating factor of the establishment and development of aerial transportation.

It seems that aeroplane service over a direct route between Germany and Russia will be put in operation in the spring, cutting the time between Berlin and Moscow to only 22 hours. Aeroplanes will be used from Moscow to Koenigsburg, where arrangements will be made for direct connections with night trains coming to Berlin. The new German-Russian aircraft company, which has just been organized for this purpose, is financed by the Russian Government and by the Aero Union. The latter is owned by the Elektricitats Gesselschaft, the Hamburg-American Line and the Zeppelin Airship Company.

It is worth mentioning here that the plan of establishing connections with Russia and the rest of Europe, was conceived by France as early as the summer of 1920 when negotiations were started between the Denikine Government, the Russo-Asiatic Bank and a group of French aircraft manufacturers for the establishment of aerial lines in the Donetz Basin for the transportation of mail and freight.

The proposal advanced by the Russians was, first: the French aircraft manufacturers were to supply the flying materials needed, aeroplanes, equipment and spare parts. A company would have been started for the exploitation of the aerial lines, and French aircraft manufacturers would become stockholders in this Company to the extent of the sale price of the material furnished, the balance of the capital needed being subscribed by the Russo-Asiatic Bank. The dividends of such a business enterprise being paid to French aircraft manufacturers in fuel for an equivalent value. These conditions were accepted by the aircraft manufacturers with the exception that they asked that half the price of the material supplied by them, be paid in francs, so that they might become stockholders in that company to the extent of one-half only of the sales price of their material. The payment of dividends in fuel was accepted. These negotiations could not be brought to a conclusion on account of the downfall of the Denikine Government, but the points agreed upon show at least that French aircraft manufacturers were willing as early as two years ago to risk their benefits in such an enterprise. Apparently the Germans have now succeeded in entering into an agreement with the Soviet Government in Russia for establishing aerial communications between Germany and Russia. There is not the least doubt that the first initial step will be followed later on by further expansions.

When we consider the large land extent of Russia, the rudimentary state of railways, the great distance separating commercial centers and the enormous commercial opportunities to be found in Russia, we can easily realize how important it will be to establish and operate lines such as Petrograd-Moscow, Kieff-Odessa-Italta or Petrograd-Moscow-Kharkoff-Wladkovkaz, covering these distances in 24 hours. The trip Moscow-Tokio or Moscow-Pekin, trans-Siberian lines, could be made in three days. The international lines, Paris-Moscow in 24 hours, Berlin-Warsaw-Moscow in 10 hours, Odessa-Bukarest in 3 hours, Petrograd-Stockholm in 5 hours, Petrograd-Copenhagen in 9 hours, Odessa-Constantinople in 4 hours, Odessa-Vienna in 6 hours, London-Calcutta passing through Tarnopol, Astrakan, in three days, are of such importance that I do not need to emphasize.

Various lines are now in operation in Germany between Berlin-Leipzig, between Nuremburg, Munich and Augsbourg. The operating companies are subsidized by the Government and the Deutsche Luft Reederei of Berlin, in 1920, received 15 millions of marks subsidy from the Government. This company is one of the most important and the best organized of the aerial transport companies in Germany.

At the general meeting of the Deutsche-Luftfahrerverband, on October 22, 1921, the consolidating into one single company of the Deutsche-Luftfahrerverband, the Aeri-Klub von Deutschland and the Allgemeine Deutsche Flugverbang was decided upon. The new company thus formed will take the name of Deutsche Luftfahrtverband.

Most of the aerial lines in Germany suspended their activities in October of last year and the service will not be resumed before March, 1922. In the meantime, it is most likely that new lines of operation have been taken into consideration and by next summer we might anticipate quite a lively start of commercial aviation in Germany.

Besides the aerial lines as mentioned above, another line was opened last year between Dantzig, Koenigsberg and Memel. Also in September of last year a line between Riga and Reval was opened up. This line is operated in connection with the Dantzig, Koenigsberg, Memel, Riga line.

Departure from Dantzig taking place three times per week, Monday, Wednesday and Friday, starting from Dantzig at 9 A. M., starting from Koenigsberg at 11 A. M., and starting from Memel at 1 P. M., arriving at Riga at 3.30 P. M.

Departures take place from Riga every Tuesday, Thursday, and Saturday, starting from Riga at 10 A. M. arriving at Reval at 12.30 P. M.

For the return trip. departures from Reval occur every Monday, Wednesday and Friday, starting from Reval at 1 P. M., arriving at Riga, 3.30 P. M.

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Departures from Riga every Tuesday, Thursday and Saturday. Starting time from Riga, 9 A. M., starting time from Memel, 12 noon, departures from Koenigsberg at 2 P. M., arriving at Dantzig at 3.30 P. M.

Mail matter is accepted on this line with ordinary postage stamps for foreign mail. Mail matter starting from Berlin can reach Riga after 38 hours. This is the first attempt to start Air Mail Services in Germany.

Before concluding, we might add that scientific research work in aerodynamics and sciences thereto allied has been conducted throughout the war and since the war by the Germans with the most gratifying results, in fact, we might safely say that the Germans have contributed to the development of aeronautics as a science and as a branch of engineering more than any other nation up to the present time.

In dirigible construction it is well acknowledged by everybody, the leadership of the Zeppelin and the Schutte-Lanz firms in rigid dirigibles design and construction. Also in metallic aircraft construction, the advancement made by Germany in this line is well known. Metallic aeroplanes made by Junkers, by the Zeppelin firm and by Dornier are well-known, and it is admitted by everybody that in this line of aircraft manufacturing industry, the Germans are so far unexcelled by other nations. (*To be concluded*).

THE AERIAL JOURNEY FROM LONDON TO PARIS

A SCOTCH clergyman, Rev. H. S. M'Clelland, writes an interesting story of his journey by air from London to Paris in a recent issue of the Glasgow *News*, as follows:

"The day on which I travelled by the London-Paris air mail, the conditions were perfect for flying; scarcely a breath of wind on the ground, hardly a cloud in the sky. We arrived at Croydon (London) about 10:15. Here are the offices and aeroplane sheds of all the great air lines to the Continent—the Handley-Page, Instone, Grand Express Aeriens, &c., each flying its own 'balloon.' A huge star in red sandstone marks the center of the aerodrome. Away to the left the new anchoring mast for airships rises several hundred feet in the air. A score of aeroplanes de luxe, all of them of tremendous wing-spread and colossal engine-power, line the ground, around one of which, a huge Vickers-Vimy, Rolls-Royce, Limousine, of 470 h. p., a group of mechanics are busy. We knew instinctively that it is for us they were waiting. Five minutes more and we are through the Customs, have had thirty pounds of free luggage carefully weighed, and are being helped into the car of this leviathan of the air. I found myself sitting in a well-ventilated saloon with ample room for movement. There were eight passengers in the car, and we sat four-a-side, with a small passage down the middle.

"Through the window I can see our young pilot putting on his air-mask A yellow bag, wax sealed, is handed to him. It is the air mail. He flings it into the driving seat and jumps in after it. Down below several mechanics in brown overalls are swinging the long blades of the propeller to and fro. My watch records half past ten.

"'Stand clear!' rings out an order. 'Contact! Contact, sir!' The great engine opens with an earth-shaking roar, and grows louder and louder. Someone kicks the blocks away from the runners. The huge machine leaps forward like a greyhound from the leash, and gathering speed as it goes, it travels at a terrific rate for the end of the aerodrome. This, of course, is the critical moment of the ascent. We appear to be making straight for a clump of trees. If we don't take the air soon . . . Ah! I thought so. The jolting, bumping ceases, and the slight roll from side to side tells us that our 'runners are up,' that we have left the ground. Now we are facing the aerodrome again, but the sheds are several hundred feet beneath us, and a group of Lilliputian figures are waving us farewell. Rapidly we climb to five thousand feet, and the scene below grows passing strange. The dull yellow dauhs, with the ditches between them, that marked the southern suburbs of London soon pass behind the Kentish hills. Now we are passing over open country, where the cultivated fields look like the tiny squares on a patchwork quilt, whose dominant colors are green and gold. Toy motor cars, with clouds of dust behind them, crawl sleepily along the white road-ribbon that covers the country side. It is interesting to study the various patterns of the corn-sheaves that are standing in the yellow fields. The black threads that seem to tie the towns together are railways, on one of which a train is disappearing into a tunnel. It looks like a tired worm crawling wearily into its hole. Those black spots, here and there, are farmsteads. Towns you see long before you reach them, and you see them all at once. They never look beautiful from the air. They remind one of warts.

"That shining string of diamonds is the Medway, dancing in the sun. All this you see if you look down. To look straight out of the window is to see the huge struts and mighty wings of this great bird of passage, upon which for another hour our very lives depend. The aeroplane rolls in the air like a ship. Some of our number are showing signs of air-sickness, though 'air pellets' were given to us all before we embarked, with fullest instructions as to their use if we 'felt queer in the air.'

"We left the English coast at a quarter past eleven, somewhere between Hythe and Folkstone. We had descended to 1,500 feet and could plainly see the watchers on the sands. No language of mine could describe the magic of that crossing. Behind us the rolling downs of Kent; beneath us the dancing waters of the Channel; before us the pine-clad sand-dunes of the Pas de Calais. Only five ships of any kind were visible beneath us, the largest of them a P. and O. liner, looking like the sort of thing the London children play with on the Round Pond in Kensington Gardens.

"But already the Irisnez lighthouse was poking its long nose up at us as we passed over her, Boulogne was spreading itself out beneath us, has passed behind us, and we were flying above the ruins of the British hospital camp on the brown Etaples sands. I looked at my watch. It was exactly eleven minutes since we left the English shore! We now turned due south, but climbed gradually to six thousand feet to get above the haze driving in from the sea. Little could be seen with any clearness from that altitude, save the long, straight public roads for which France is so famous, with the black shadows of the poplars lying flat on the white surface. As we passed over Montreuil, about 11:45, for three years the British Army G. H. Q., I found myself wondering how many German bombing planes had searched these areas in vain. Twelve o'clock found us flying over the battlefield of Crecy. A few minutes later Abbeville lay behind us, and we were across the wide estuary of the Somme. We had now been in the air for nearly two hours, and even for our youngest passenger, a young girl of seventeen, the novelty of the experience was passing. We began to take more note of each other. A passenger in the back seat is reading a French novel. Several of us are busy photographing the interior of the saloon, and vainly attempting to get 'exteriors' as well. One timid friend, to whom courage is now returning, asks his neighbor to try a snapshot of him! 'I guess I'd like a memorial of this fool trip,' he says, 'for they'll be flying to Mars before I take another!' 'What do you mean?' replied a Toulouse pilot. 'What do you mean, you'll never have another? Why I'll be flying you next week to Rabout!' 'I guess you won't,' drawled the American, 'the next time I'm up as high as this, the good Lord'll be takin' me to glory!'

"It was now 12:40. We had passed over Poix and Crevecour, Beauvais and Pontoise, when, away in the distance, with the silvery Seine, like a shining serpent, winding all about her, I caught my first glimpse from the air of the gay French capital, nestling like a jewel in a velvet casket, in the woods of Chamberg and Versailles. Suddenly, and to most of us unexpectedly, for we were still a long way from Le Bourget, the roar of the great engine ceased, the air became strangely still, and we felt ourselves falling earthwards, and turning as we fell. Our American friend kept his eyes fixed on the height indicator. 'Six thousand feet!' he read breathlessly, 'five thousand, four thousand, three—' With a mighty roar the engine started again. We rose rapidly a thousand feet, turned on our track and came down in a sweeping curve. The American could stand it no longer. 'For God's sake, Mr. Pilot,' he cried, 'don't change yer mind! Keep on goin' down. Keep on goin' down!' The pilot evidently knew his own mind quite well. We came down the remaining half mile in a series of volplanic spirals that landed us right over the star in the center of the aerodrome.

"We landed at 12:46, having covered the 260 miles between the two capitals in two hours and a quarter, an average of two miles a minute! Half an hour later I was lunching at the Hotel Continental with some of my fellow adventurers. 'What are you doing with yourself this evening?' I asked of one of them in whom I had already found a friend. 'I'm thinking of going to the "League of Notions?"' he replied. 'Do you know anything about the show?' '"The League of Notions?"' I answered in great surprise, I didn't know that was to be seen in Paris.' 'It isn't,' came his quiet answer. 'I'm flying back to London by the four o'clock plane.'"

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NAVAL and MILITARY AERONAUTICS

Air Service Denied Participation in National Rifle Matches

The Army Air Service has found it necessary to abandon its plans for participation in the National Rifle Matches to be held at Camp Perry, Ohio, this coming fall. Basing his request on the fact that the Executive Committee of the National Board for the Promotion of Rifle Practice contemplates the participation in the National Rifle Matches of a team from each of the combatant arms of the Army, the Chief of Air Service, on February 27, 1922, made application to the War Department for the participation of the Air Service in these Matches, stating that the necessary personnel to form a team is available this year, and that such participation in these Matches would stimulate interest in the manipulation of small arms among both officers and enlisted men. It was also stated that it is planned to assemble about 42 officers and enlisted men, exclusive of a team captain and team coach, at the National Guard Rifle Range at Virginia Beach, Va., on or about June 1st, for preliminary training and tryouts, after which a final selection would be made of 24 men who will proceed to Camp Perry as the Air Service contingent.

The War Department's decision, disapproving the application, is based on the fact that only about one-third of the entire personnel of the Air Service is armed with rifle, and that the units are so equipped merely for purposes of defense.

Students Finish Primary Training

The Academic Board at Carlstrom Field met on March 7th for the purpose of passing and making recommendations on the class of student officers and cadets who commenced the course last September and who have now completed their primary training. Some fourteen officers and twenty-five cadets appeared before the board and were recommended for advance training, 10 per cent. of the class being assigned to pursuit training, 25 per cent. to bombing and 65 per cent. to observation. Orders have been requested for the assignment of this class to advance training schools.

Reserve Squadron Stages Aero Circus

San Jose, California, the home of the 440th Aero Reserve Squadron, was treated to an unusual event the latter part of February, the occasion being the Flying Circus held at that place under the auspices of that squadron. Some of the commissioned personnel from Crissy Field, Presidio of San Francisco, Calif., including Major George H. Brett, commanding officer; Captain A. W. Smith, Flight Surgeon, and Lieutenants Batten, Maxwell, Kiel, Liggett, Patrick and Catlin, flew to San Jose to witness the event. The Circus attracted approximately 20,000 spectators and had successfully run the gaunt of aerial stunts peculiar to aerial circuses, such as spectacular stunt flying and aerial acrobatics, with Mr. Pangborn, civilian pilot, Captain Lowell Yerex, famous English "Ace," and "Jinx" Jenkins, known from one end of the Pacific Coast to the other for his feats of aerial daring, as the principal participants, up to the last act.

As has been the case during previous circuses in which "Jinx" Jenkins had participated, he was concluding his performance with a parachute jump from an altitude of approximately 2,500 feet. He had scarcely jumped from the plane, however, when it was evident to the horror-stricken onlookers that his parachute had failed to open; and despite desperate struggles up to almost the very moment when he struck the ground, "Jinx" was unable to make his parachute function. "Jinx" numbered amongst his friends many of the officers at Crissy Field, and the untimely death of this young man is sincerely regretted by all who knew him.

Boosting Aeronautics in California

At a meeting held on February 28th at the City Hall of San Francisco, an Air Service sector of the Association of the Army was organized. Major H. H. Arnold, Service Air Officer of the 9th Corps Area, was elected President thereof, and 1st Lieut. Robert E. Selff, Air Service, of Crissy Field, was chosen Vice-President. The object of this organization is to foster aeronautical development in general, and to create and aid in every way possible among the various branches of the Army interest in matters aeronautical.

Aero Tactical Demonstration at Luke Field, H. T.

Luke Field, H. T., was the scene of a tactical program demonstrating the different phases of aerial activities under war conditions, on Saturday, February 11th, on the occasion of the visit of Major General C. P. Summerall, Commanding General, Hawaiian Department, on a tour of inspection, accompanied by Governor Farrington of the Territory of Hawaii. All planes were on alerte. At the zero hour an HS2L seaplane took off on a reconnaissance mission, Ford's Island representing the Island of Oahu for this mission. Radio communication was established between the seaplane and the Group Radio Station (5th Group, Observation) and the observer of the seaplane reported the approach of the "enemy." Upon receipt of the message requesting that an air force be sent to drive off the landing parties, the alarm was sounded, the motors started and in a very short time five planes took off in perfect formation and carried out a dive attack and bombing raid in the harbor representing the "enemy." At the conclusion of the raid, the planes passed in review, all observers at salute. The Commanding General returned the salute and the planes circled and landed.

Next came a bombing raid of the island by one ship over the camera obscura making four shots up wind until engaged and driven off by the Fokker. Lieut. Miller then demonstrated the maneuverability of the Fokker. The bombing plane then carried out a radio-panel communications mission, establishing communication between the plane and radio truck set upon the field. At the conclusion of the mission, the message was dropped and checked made of all the shops and departments, including the barracks of the 6th Squadron.

M. B. VII Makes Another Trial Flight

The little monoplane of the Thomas-Morse Aircraft Corporation which is being tested at Mitchel Field, L. I., New York, was given its second flight on with the record at the truck. Following the flying program, an inspection was March 10th by Lieut. Fleir of the Marine Corps. The officers of Mitchel Field were eager spectators as Lieut. Fleir drove the little racing plane around the course. Again, as before, all were of the opinion that the MB VII will develop great speed. Lieut. Fleir thought she was making at least 185 miles per hour at one time. He only opened the motor up on one occasion, and then only for a brief time.

Post School at Mitchel Field Makes Gratifying Progress

After its first experimental week, the Post School at Mitchel Field settled down to its task of giving a rapid one month's course in the necessary subjects to fit a recruit or unskilled soldier for a crewman. The weekly examinations on Friday, March 10th, served as a means of eliminating those who are unfitted, by reason of lack of intelligence, education or industry, to stand the strain of rapid progress of the classes. Those who yet remain, however, about 150 in number, are working hard, making progress, and will be turned out on April 1st with sufficient knowledge of airplane and airplane motor mechanics to make them serviceable crewmen for the summer's strenuous flying activities.

Air Service Observation School in Full Swing

The ending of the sixth week at the Air Service Observation School at Post Field, Fort Sill, Okla., finds the present class beginning class room work. To date, all work has been strictly practical—actual work on engines and planes, in addition to flying, has obtained. The seventh week brings up the theory of Reconnaissance, Photography and Artillery adjustment. These subjects occupy one-half of each day, the other half, as heretofore, being devoted to flying.

The School was visited the early part of the week by a delegation of Japanese Army officers. They were shown the various activities and seemed to take much interest therein. A problem was fired for them on the miniature range. The speed and facility with which artillery fire may be directed on a target by aerial observation was very well demonstrated to the gratification of the visiting officers.

The next eight weeks will constitute the most difficult part of the course. During this period a great variety of subjects will be covered, and some thirty missions will be flown by each student, in addition to the daily routine flying.

The past week has brought with it a variety of good and bad weather; the latter, however, has had little effect upon the schedule, due to the alternate work prepared. With spring, work should proceed very smoothly, and the indoor part completed, leaving only the final stages of flying to be accomplished.

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FOREIGN NEWS

France's Great 1924 Competition

From France it is reported that the prize of one million francs offered by the French Society for Aeronautical Propaganda for the "best" aero engine will probably be augmented by another million offered by the French Air Minister. But few details are to hand at the time of going to press, but it appears that the competition will be for engines of 350–450 h.p., and weighing not more than 2 lbs./h.p. It is understood that competing engines will have to pass a reliability run of 240 hours, in stretches of eight hours each, and that the total time taken in completing the 240 hours must not exceed 100 days. The competition will start on March 1, 1924, and entries must be received before December 1, 1923.

Belgian Aero Club Competition for Touring Machines

Details of the Internationa. Competition for Touring aeroplanes organized by the Ae.C. of Belgium at Brussels on June 23-25 are now to hand. The competition is open to touring machines, single-seaters or multi-seaters, whose engine capacity does not exceed 7 liters. The course is to be Brussels-Gosselies (landing) 47 km. Gosselies-Brussels-Brussels-Gosselies (landing) 141 km. on Saturday, June 24. The awards will be made for a total of 100 points, allotted as follows: 30 points for minimum of space occupied in the garage, 30 points for general economy of the engine, 25 points for slow landing, and 15 points for quick get-off. The machines entered must be on the Evere aerodrome at Brussels before noon on June 22. The prizes are as follows: The King of Belgium's Challenge Cup, to be retained by the winner for one year; and the following cash prizes: 1st prize 15,000 francs; 2nd prize, 7,000 francs; and 3rd prize, 3,000 francs. All enquiries should be addressed to Secretariat de la Commission Sportive, Aero-Club de Belgique, 73, Avenue Louise, Brussels. The entrance fee, returnable if machine starts, is 100 francs, and should be sent to the Treasurer of the Belgian Aero Club before June 10.

Cairo-Bagdad Air Mail

The British Postmaster-General stated on March 2 that the air mail which was dispatched from London on February 9 reached Bagdad on February 27. The mail due to be dispatched by air from Bagdad on February 18 reached Cairo on February 23, and letters included in it for England arrived in London on March 3.

French Air Traffic

The French Department of Aeronautics and Air Transport has issued a statement giving traffic figures in connection with the progress of commercial aviation in France during the years 1919, 1920 and 1921. Considering the handicap under which aviation has been carried on by the companies concerned, these are very encouraging. The following is a summary of the official figures:—

Year.	Journeys made.	Miles covered.	Passengers carried.	Parcels, lbs. (approz.).	Letter Mails, lbs.
1919	988	158,606	588	14,000	900
1920	2,386	529,454	1,721	110,000	9,000
1921	6,221	1,457,437	10,336	375,000	21,000

Figures which are available for the air mail between France and Morocco for 1921 are also very instructive. In the "round" journey there and back the increases have been very marked. In January, 1921, the total was 16,377 letters; in January, 1922, the number was 50,851, equal to over 300 per cent. increase. Curiously, the dispatchings from Morocco to France were greatly in excess, viz., 32,691, as against 18,160 in the reverse direction. So steady has been the growth of the air mail that it has determined the Secretary of State to augment the facilities by increasing the service between Toulouse and Casablanca from three to five times per week as from this month—necessitating a fleet of 90 craft. The following monthly figures of letters carried during 1921 speak for themselves:—

February, 12,025; March, 14,005; April, 17,179; May, 18,878; June, 22,738; July, 28,108; August, 34,283; September, 35,006; October, 40,601; November, 41,330; December, 47,235.

"Safety First" Air Prize

A prize of 25,000 francs is offered by the French "L'Union pour la Sécurité en Aéroplane," for the best safety device or scheme for flying in fog or at night submitted during 1922. Details governing the award are not yet available, but those interested can communicate with the Association at 35, rue Francois-Ier, Paris.

Seaplane Contest at Marseilles

It is announced that the Aviation Committee of the Colonial Exchequer, to be held at Marseilles this year, have definitely decided to ganize a contest for seaplanes from April 17 to 19. There will be three categories: under 150 h.p.; 150 to 400 h.p.; and over 400 h.p.

Eliminatory trials are to take place on April 17 when entered craft must ascend to 1,000 meters, and have on board, in addition to the normal useful load, sufficient fuel for 1½ hrs. flight. The course, Marseille-Monaco, is 413 km. Prizes to the extent of over 40,000 francs are offered. An entrace fee of 200 francs (returnable in its entirety) obtains, and communications should be addressed to the Aviation Commission, A. C. de France. Military competitors will take part *hors concours*, a trophy being their recompense.

To Improve Upon "Landing" on Water

In France our contemporary *L'Auto*, has raised the point of finding a verb better to define "landing" on water. Suggestions, weird and otherwise, are naturally forthcoming, amongst them being aquair, aquater, and afflotter. For our own part, we get over it by putting the trouble on to "alighting."

Gliding in Germany this Year

From reports from Germany it appears that the gliding competitions which started on quite a modest scale a couple of years ago are to assume greater proportions in the future. Not only are the Rhön competitions to be resumed this summer, but it is stated that a new prize of 100,000 marks is to be offered for the first German glider which makes a flight of 40 minutes' duration over a course similar to that of a yacht race. Presumably this means over a triangular course. The prize, it is reported, is to be offered by the Society of German aircraft constructors, after consultation with the German Aero Club, and the German Aeronautical Society. The conditions are sufficiently difficult, coupling as they appear to do a duration of 40 minutes with a specified course. One or the other might be fairly easily attainable, but the combination of the two is so difficult that one doubts whether the prize will be won for some considerable time.

Mountain Reconnaissance by Air

An officer of the Geodetic Mission in Syria has carried out recently an aeroplane reconnaissance of the zone which he is engaged in surveying. The object of the experiment was to prove whether it was possible by flying over a region, such as the anti-Lebanon Mountains, to get an exact idea of the differences in height of the summits and consequently to be able to select the points to be used as a basis for triangulation. The experiment proved very satisfactory and several weeks' time was saved.

German Aviation

The following is a translation of an article by Lieut.-Colonel Reboul of the French Army, which appeared in a recent issue of the French publication *Le Temps*:

The Ministry of War of Germany has just published regulations which enlighten us on the state of mind of the German High Command and its designs. The "Instruction on the employment of aviation to be used for maneuvers, regimental exercises and drills in tactics" is a statement in concise form of the opinions of the German High Command on the employment of aviation during the war.

Article 198 of the Treaty of Versailles prohibits Germany from keeping any aeronautical force whatever. This, however, does not prevent the Minister of War from declaring in this instruction: "In the distribution and employment of the aviation formations we have taken as a basis a modernly equipped army for use in giving decisive combats." It does not prevent the cadres of the *Reichswehr* from already undergoing training in the use of the aeroplane. In their *kriegspiele* they assign missions to it and receive information from it. They are accustoming themselves to handle it, to consider it as an arm, the collaboration of which is indispensable. They are making preparations to use aeronautics in connection with the other arms.

Doubtless the *Reichswehr* will be unable to begin the actual exercises so long as our control commissions remain in Germany. But the day they leave, the "Instruction on aviation" will immediately be put into effect. The plan being already known to all, it would require but a short time to put it into operation and have an aviation force working in close union with its command, its infantry, its artillery and its cavalry.

Chapter II of the regulations treats of the aerial formations. It provides for an exceedingly high aviation equipment for each large unit.

The Infantry division includes organically a strong squadron of two escadrilles. One of these, the reconnaissance escadrille, will be used for close missions and for observation of the battlefield. The other will work with the divisional artillery. Each of these escadrilles comprise 12 aeroplanes. The German army thus realizes the desiderata which we expressed at the end of the campaign of 1918. The division is henceforth permanently equipped with its eyes and observers. Its aviation will work constantly with the same units. They know one another wonderfully well; they have confidence in one another; they conform to one another's customs and idiosyncrasies. The results will be incomparably greater than those obtained with escadrilles that are assigned only temporarily to the divisions. At the moment that everyone begins to speak the same language the escadrille is replaced by a new one. Everything must be begun all over again.

The army corps has its own squadron which has the same composition as the divisional squadron. Its reconnaissance escadrille will specialize in photography and in night reconnaissance; its artillery escadrille will regulate the heavy artillery firing of the army corps.

The army is very strongly equipped with aviation units. The regulations provide for the assignment to it of one observation squadron, combat squadrons, pursuit squadrons and bombarding squadrons.

The observation squadron is of the same type as the divisional squadron; but its aeroplanes will as a rule be superior. They will, in fact, penetrate more deeply into the enemy lines. The reconnaissance escadrille will make distant reconnaissances and photographs of the enemy's rear areas. The artillery escadrille will regulate the fire of the high powered heavy artillery which will be directed against the enemy quarters, its parks, railways, installations and points through which it is compelled to pass.

Each army in active operations has assigned to it a combat unit with a strength of 3 or 4 squadrons. Each squadron comprises 4 escadrilles of 12 aeroplanes each. This represents a body of 150 to 200 aeroplanes which will have as its mission to take part in all the phases of the battle, both in aerial combats and in combat against the other arms. In an attack it will act with the assaulting troops, will precede the first waves, mowing down the enemy reserves and bombarding the centers of resistance.

The pursuit unit will be especially charged with the aerial fighting. It comprises from 4 to 6 pursuit squadrons, each squadron comprising 3 escadrilles of 21 planes. Its mission is to hinder the enemy reconnaissance and prevent the enemy combat aviation from taking part in the battle. It must enable its own reconnaissance aeroplanes to accomplish their mission. Its object is aerial combat. Pursuit planes should act in mass so as to be master of the air, at least during certain hours. They may be reinforced for certain missions by combat and bombarding squadrons.

The bombing aviation is less strong numerically than the combat and pursuit aviations. It consists of from 1 to 3 squadrons, each formed of 3 escadrilles of 12 planes. It is to be used in bombarding by day as well as by night.

The group of armies has only a very limited aviation force, which consists of one escadrille of 12 planes for making reconnaissance which are of special importance to it and which it wishes to entrust to observers whom it knows and can rely upon, and one artillery escadrille of 12 planes for the long-range and very mobile guns, especially those on railways, which it fires now in one direction, now in another.

The General Headquarters reserves a few combat and pursuit squadrons both for its own safety as well as for an aerial reserve. It will itself conduct the fighting against vital points in the enemy's back areas by means of bombing squadrons and giant aeroplanes which it will bring into action.

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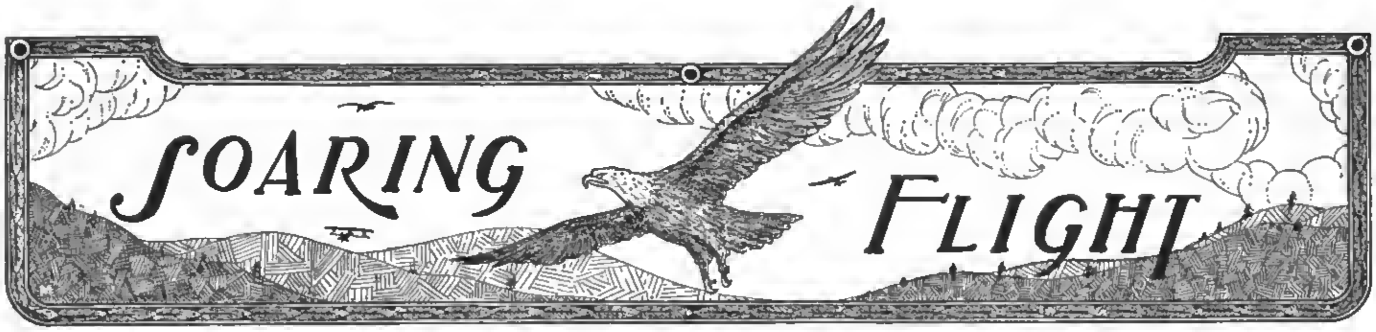


A Study of the Vulture and Golden Eagle

(*Continued from page* 89).

WHEN one goes still-hunting for a Tawny Vulture, upon first coming into sight he does not appear to be a large bird. At the altitude at which be habitually soars he appears to be about the same size as the Kites and the Egyptian Vultures—he makes no more impression than they. One learns quickly to distinguish him by the angle to the front produced by his wings, by the absence of wing beats, and above all, by the slowness and steadiness with which he moves in space. This is an infallible sign by which to recognize him as far as the eye can distinguish. It is only later that his true size will be understood, when he is only 100 or 300 yards off. As he approaches within that distance he grows in appearance much faster than the other birds.

He is further distinguished by the peculiar spread of his wing tips. This is the bird who spreads his primary feathers most widely apart. At the extremity there is an open space between each quill equal to about five times the width of the feather.

Still another peculiarity is that the primary feathers, instead of tapering toward the point, are constructed on the reverse plan; they seem to be implanted into the wing by the thin end, the outer tip being materially wider than the part which seems to be attached to the wing and which precedes the main widening of the barbs. These large feathers, widest at their tip and spread asunder, present a curious outline which would please artists greatly if they observed this bird in bis native habitat.

To the peculiar construction described we must add the effects of the partial rotation of the quills within their sockets, which action is observed only in these large birds. The quills must be wonderfully strong and elastic, for the birds put them to severe proof. During the efforts which he makes when starting up from the ground and when his pectoral muscles are doing their utmost, the tips of the feathers point directly to the zenith. In short, from every point of view these great birds are exceedingly interesting to observe when free. There are attitudes quite unknown to those who see the bird only in museums.

But there must be freedom. Otherwise we have only Eagles motionless as milestones, or ill-smelling Vultures apparently worrying themselves to death, their heads smothered between their shoulders, two aspects which have nothing in common with that of these kings of the air proudly traversing the immensity of the skies. One circumstance which frequently deprives the observer of the chance of witnessing their interesting evolutions is the bird's alarm. At the slightest apprehension, these great creatures resort to rowing flight, seeking to get rapidly beyond danger. So, developing all their powers with strokes of wing, they quickly fly away.

Their power of vision must be great; we may safely assume this, because these birds, of all flying creatures, are those whose mode of life requires the most extensive views.

A sparrow needs a field of view of but a hundred yards. A more powerful organ of sight would be needless, and therefore atrophied in a few generations. The sea birds need to observe the surface of the waves for only a dozen yards or so. It is not among these creatures that those perfect lenses are found, capable of collecting all divergent rays of light.

The hunting birds of prey, such for instance as the Falcons and the Eagles, often scrutinize the surface of the ground from a great height. The latter birds sometimes remain at an elevation of 400 or 500 yards while hunting, but what is that distance when compared with the 3 or 4 miles required by the Vultures to study their field of research?

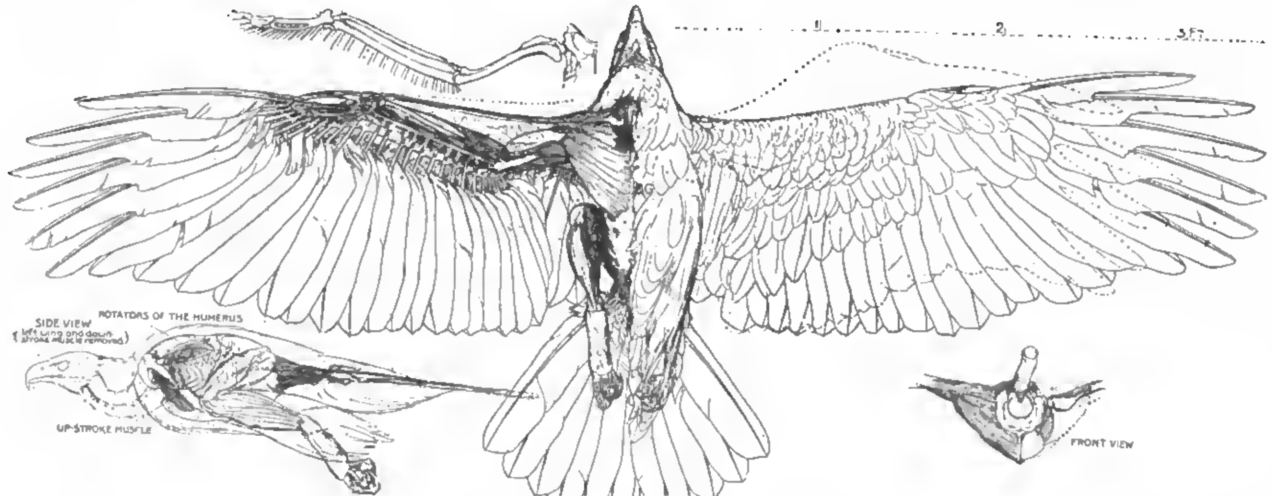
We may safely conclude that the constant necessity for seeing further than other birds has caused them to acquire in the organ of vision a perfection not possessed by other birds. We must therefore render ourselves invisible to them in order to be able to witness their extraordinary evolutions when sailing. Or, better still, we must seek them in the primitive countries where they have not yet learned to be afraid of man, and even there, clothes which shall not attract the attention should be worn, for otherwise they will not come down to a meal.

Unfortunately the Vulture is an unknown bird to those interested in the problem of soaring flight, for comparatively few people have seen him in the air. In Algeria, even in Cairo (where there are some sailing over the city every day during three months of the year) most of the European residents are unaware of their existence. But when the student takes the pains to go where the bird is to be found; when he sees this great animal, large as a sheep, painfully rising from the ground with strokes upon the air whose hissing is heard 300 yards away in the silence of the desert; when he sees them afterwards describing their endless sweeps, he appreciates this most interesting sight—every human being is chained to the spot. Even the Arab is stirred to emotion, for in this bird we have found motion under a new aspect. As to majesty and impressiveness, it resembles the action of a locomotive at full speed.

When we watch a Martin flashing through space we think of high speed mechanism; when it is a snipe or partridge which flies off, we are reminded of the action of a released spring; a gull suggests perpetual motion or the endless sweep of a pendulum, but the view of the great Vulture in sailing flight inspires at once the desire for imitation. It is a dirigible parachute which man may hope to reproduce.

The Great Golden Eagle

Undoubtedly the Eagle is the king of birds. He possesses strength and courage. Having no enemy his equal, he peacefully passes long days in the beatitude of uncontested autocracy. (*To be concluded*)



Anatomy of the Golden Eagle. Weight, 10 pounds. Loading, (wings only), 1.6 pounds per square foot. Wing span, about 6 ft. 10 inches.

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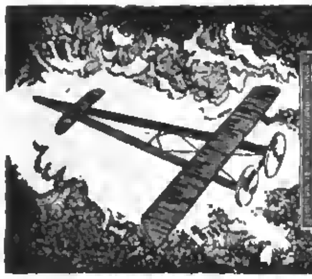
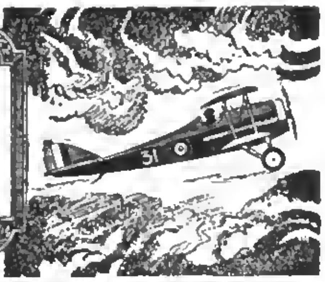


ELEMENTARY AERONAUTICS *and* MODEL NOTES



A Flying Scale Model of the Fokker F III Cantilever Monoplane

FOLLOWING the correct proportions of the Fokker-Cantilever monoplane, Mr. M. J. Bayhi of Hempstead, Long Island has designed and constructed an attractive and efficient 36-inch scale flying model. The outlines have been carefully copied in reduced scale, resulting in one of the finest scale model designs of its class.

In a model of this character, opportunity is afforded to apply some clever workmanship in the wing construction. On account of the deep section required for the cantilever bracing, and because of the absence of external stays or supports, the wing structure is built up in an unusual way. The ordinary wing spars are replaced with light stringers which stiffen the wing and give good support to the ribs.

Measurements are as follows:

Wing span (with balanced ailerons)	38¼"
Length over all	27¾"
Height at wing	9 "
Wing chord, at fuselage	6½"
Wing chord, at tip	4⅜"
Size of landing wheels	2 "
Propeller diameter	12 "

A record was made of the weights of each separate part, accurate to within one-one hundredth (1/100) of an ounce. These weights total up to nearly 9 ounces for the complete model. The wing weight includes the aileron weight also. The fuselage weight includes also the weights of landing gear, tail unit and power unit. Landing gear weight includes wheels. Tail unit comprises the rudder, stabilizer and elevators.

List of Weights:

	Ounces
Model complete and ready for flight	8.96
Wing	2.30
Fuselage complete	6.66
Landing gear	1.32
Tail unit	.21
Propeller	.94
Power plant (not including propeller)	2.22
Rubber power	1.30
Cowls	.48

General Description

Fuselage

Longerons and struts ⅛" square spruce nailed and glued together.

Covering is of bamboo paper, is doped and afterwards painted Fokker style.

Shock absorbing tail skid is used.

Cowls are of sheet aluminum.

Sockets for attaching landing gear to fuselage are light aluminum tubing.

Forward part of fuselage including cowling is painted dark blue. Rear is painted aluminum color.

Empennage

All tail surfaces are constructed of ⅛" x 1/32 spruce and 1/16" diameter reed.

All controls are balanced. Bamboo paper used for covering. Whole empennage is doped and painted aluminum color.

Landing Gear

Small streamline struts are arranged as on the real machine, four struts on each side. Each "W" strut weights .01 ounce.

Wheels are 2" diameter.

Shock absorbers are used. Cross wiring in both front and rear bays.

Attachment to fuselage by means of aluminum sockets.

Propeller and Motor

Propeller 12" diameter mahogany.

36 feet 3/16" flat rubber is used for motive power.

200 turns of propeller flies the model about 100 feet.

Motor stick of ¼" x 5/16" spruce.

A ball bearing propeller shaft is used.

Wing

The wiog section at fuselage is the "Gottingen" No. 387; at tip, "Gottingen" No. 436. Wing tapers both ways. Chord at fuselage, 6.5"; at tip, 4.375". Two center ribs are located over the longerons. They are of ⅛" balsa, lightened. 14 ribs are used. The center rib on each side of the fuselage, between the centerline of the machine and the tip, is of 1/28" Spanish cedar veneer, lightened. The rest are 1/45" Spanish cedar veneer, lightened. The tip rib is faired with Balsa, thusly obtaining a rounded wing tip.

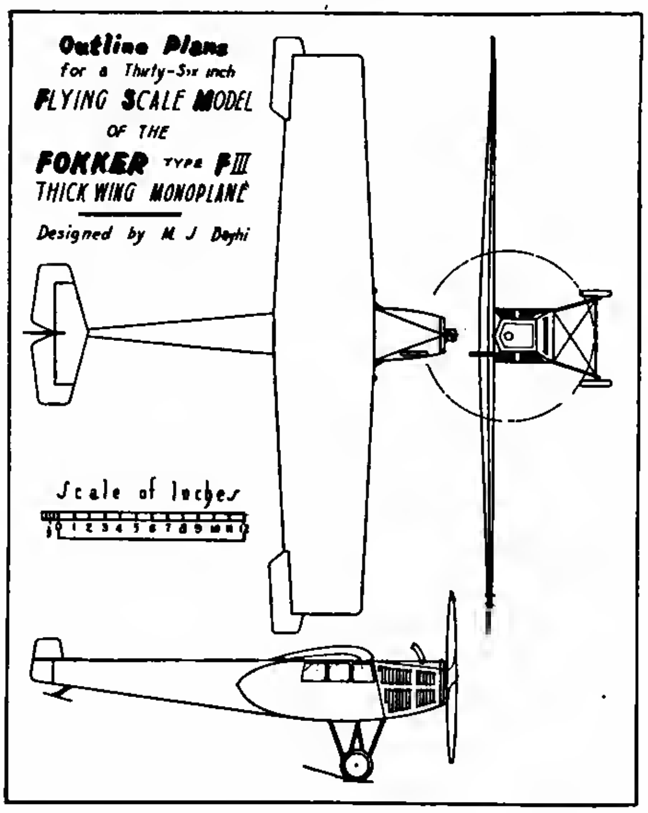
Regular balanced Fokker ailerons are used.

Wing spars are of ⅛" square spruce. Notches are cut in the ribs to receive the spars. Two spars are used; that is, one rear and one front. Both rear and front spars are constructed of two pieces. The total apnel weighs 2.3 ounces. Covered and with ailerons.

Mr. Bayhi has had good opportunities for studying the Fokker machines demonstrated by the Netherlands Aircraft Company. These machines make frequent flights at the Curtiss flying field near Mineola. Mr. Bayhi has made trips as a passenger with Bert Acosta, giving him an intimate knowledge of the flying qualities of the Fokker F III.

A later issue of AERIAL AGE will contain a photograph of this model in flight, showing its remarkable resemblance to the real Fokker monoplane.

Extensive flying tests have not been made of this model, but in the preliminary demonstrations the performance proved its correct design and balance. The propeller was given only 200 turns, and with this power the model took off the ground in a run of about five or six feet, quickly rose to a height of about six feet, descending gracefully in a glide to a point 100 feet from the starting place. The horizontal speed of the model was judged to be rather high, and later tests are to be made in an effort to increase the distance and duration flown by (1) reducing the quantity of elastic motive power, (making more possible revolutions of the propeller); (2) setting the wing at an incidence angle of one degree; (to obtain more lift) and (3) replacing the present propeller by ooe designed with a view to less speed and more efficient thrust. A later issue of AERIAL AGE will contain a photographic illustration of the model in flight, showing the remarkable resemblance to the real Fokker monoplane.



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The Aeronautis

She was shaped like a huge cigar,
  Five thousand feet long her keel,
She was built of light metal,
  Stronger than the toughest steel.
  * * *
Her diameter in the center,
  Was three hundred feet through.
Tapered to almost naught at ends.
  Only ninety was her crew.
  * * *
Her windows were made of malleable glass,
  Clear as crystal one inch thick.
She had large libraries & lecture halls,
  And a large hospital for the sick.
  * * *
Slowly the monster airship rose,
  To circle the earth in a day.
At a mile from earth she stood still,
  In the busy aerial way.
  * * *
For an hour we lay up there,
  To take more passengers aboard.
They came to a floating dock,
  By air in a veritable horde.
  * * *
This huge floating dock of the air,
  Now stood by our side.
When we had all her passengers,
  Slowly away it did glide.
  * * *
Thousands of airships passed us by,
  Some were large and others small.
There were business and pleasure ships,
  Some shot fast and some did crawl.
  * * *
The huge doors were now all closed,
  We shot straight up in space.
The ship was now airtight all round,
  The crew all in their place.
  * * *
At fifty miles from the earth,
  We first traveled forward.
At a thousand miles per hour,
  The huge ship gracefully soared.
  * * *
We scarce knew we sailed at all,
  Fifty miles from the earth.
The salons and spacious ball rooms.
  Were ringing with music and mirth.
  * * *
There was no roar of whirling props,
  There were no props or engines beat.
There was no grind of huge machines,
  To give the monster ship her speed.
  * * *
Of oxygen there was plenty,
  Twas stored in bins like salt.
Apparatus turned it hack to air,
  As need arose without a fault.
  * * *
With fine solar instruments,
  Heat vibrations from the sun
Were taken direct from the ether.
  And kept all from the cold undone.
  * * *
We seen huge freighters of the air,
  Glide swiftly past our view.
Controlled completely from the earth,
  Without a soul aboard they flew.
  * * *
The crew knew through instruments,
  When another ship drew near.
Automatically ships were kept apart,
  All ships of ships always ran clear.
  * * *
At night the glitterings in the sky,
  Were the most glorious sights.
Not seen from earth in their grandeur,
  Were the playing northern lights.
  * * *
Most people flew for health and pleasure,
  Around the world in this great girth.
By wireless always kept aware,
  Of all doings on the earth.
  * * *
The ship was run by vibrators,
  Sending out vibrations together.
Which were repelled by opposites,
  Thus driving the ship through the ether.
  * * *
Thus also was the huge ship raised,
  Lowered or turned about at will.
Going backward as well forward,
  Or in midair stand stock still.
  * * *
Through what looked like glowing bulbs,
  These vibrations were outward sent.
From nine above and nine below,
  Nine on each side one at each end.
  * * *
The wise with the low brows said,
  What a fool's imagination.
'T is all a dream a wild-eyed dream,
  Impossible of creation.
  * * *
As 'twas said of the steamboat,
  Wireless and the modern aeroplanes.
The grafaphone and automobile,
  Electric lights, locomotives and trains.

H. Theo. Haller

The Seaplane

Ye earth-bound mortals, frail and weak,
Be still and hear the Seaplane speak:

"A fair, young god just born, am I,
And I cleave the heavens as eagles fly;
My gray sides shimmer in the sun,
My taut wires sing as the race we run.
Upward, yet higher and higher I spring,
Swift as swallow with lightning wing,
Straight to the face of God.

The sea-gull swerves to give me room
And screams aloud as he hears the boom
And roar and hum of my mighty heart,
As hither and yon in the clouds I dart,
Playing "I-Spy" with the sun's bright beam
That wraps me round in a golden sheen—
A shield from the earthly sod.

I dip, I rise like the waves of the sea,
The mother whose bosom has nurtured me.
And ever and ever I feel a thrill
Of joy as I go at my master's will.
The winds beat against my golden wings;
As I dash in their teeth my soul it sings,
And I turn, and I twist, and I roll.

I scorn those weaklings caged on earth,
Of mortal soul and mortal birth;
Above, I soar, in realms sublime.
Kissed at birth by gods divine,
A god I live, a god I'll die,
For I fly to live and live to fly.
A Seaplane, I, with a god's young soul."

Julia Baker.

A Ham Joke

He—I live in my Mary's eyes.
Him—Yes, I noticed she had a sty in them.—*Lord Jeff.*

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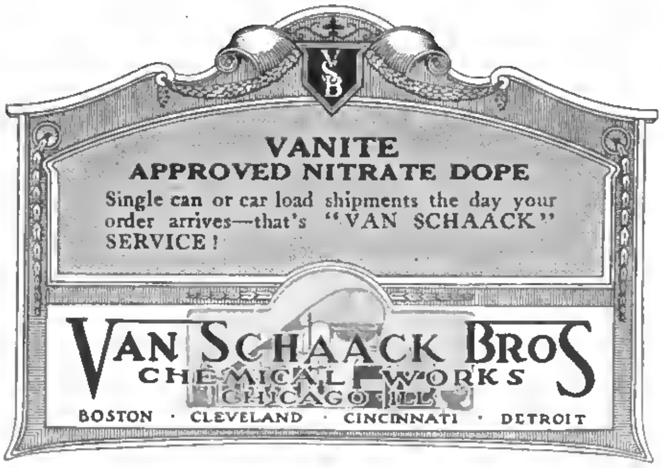

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STATE OF NEW YORK }
COUNTY OF NEW YORK } ss.

Before me, a NOTARY PUBLIC in and for the State and county aforesaid, personally appeared G. DOUGLAS WARDROP, who, having been duly sworn according to law, deposes and says that he is the EDITOR of the AERIAL AGE WEEKLY and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers, are:

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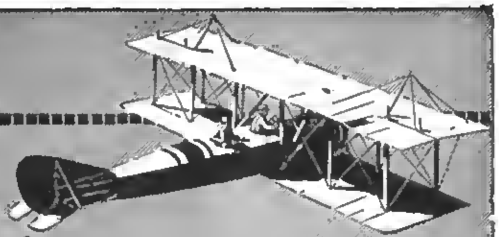

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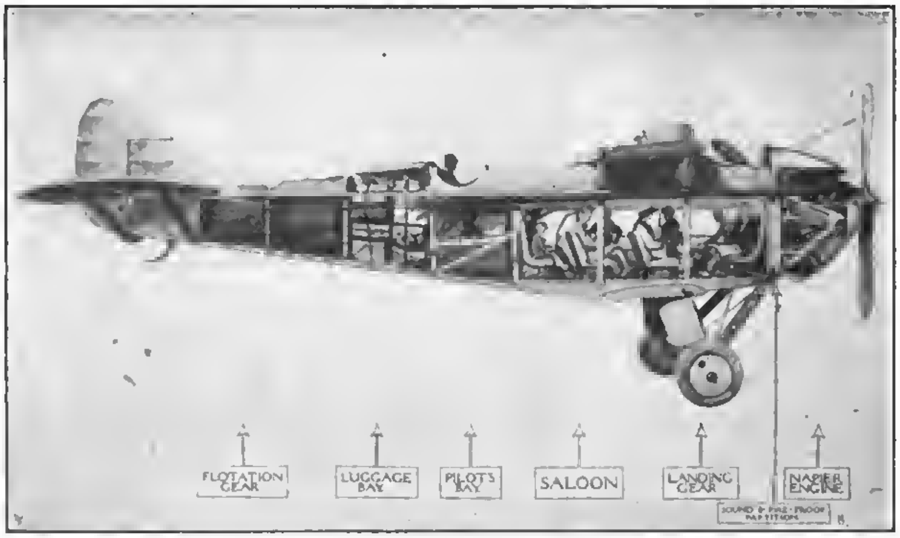

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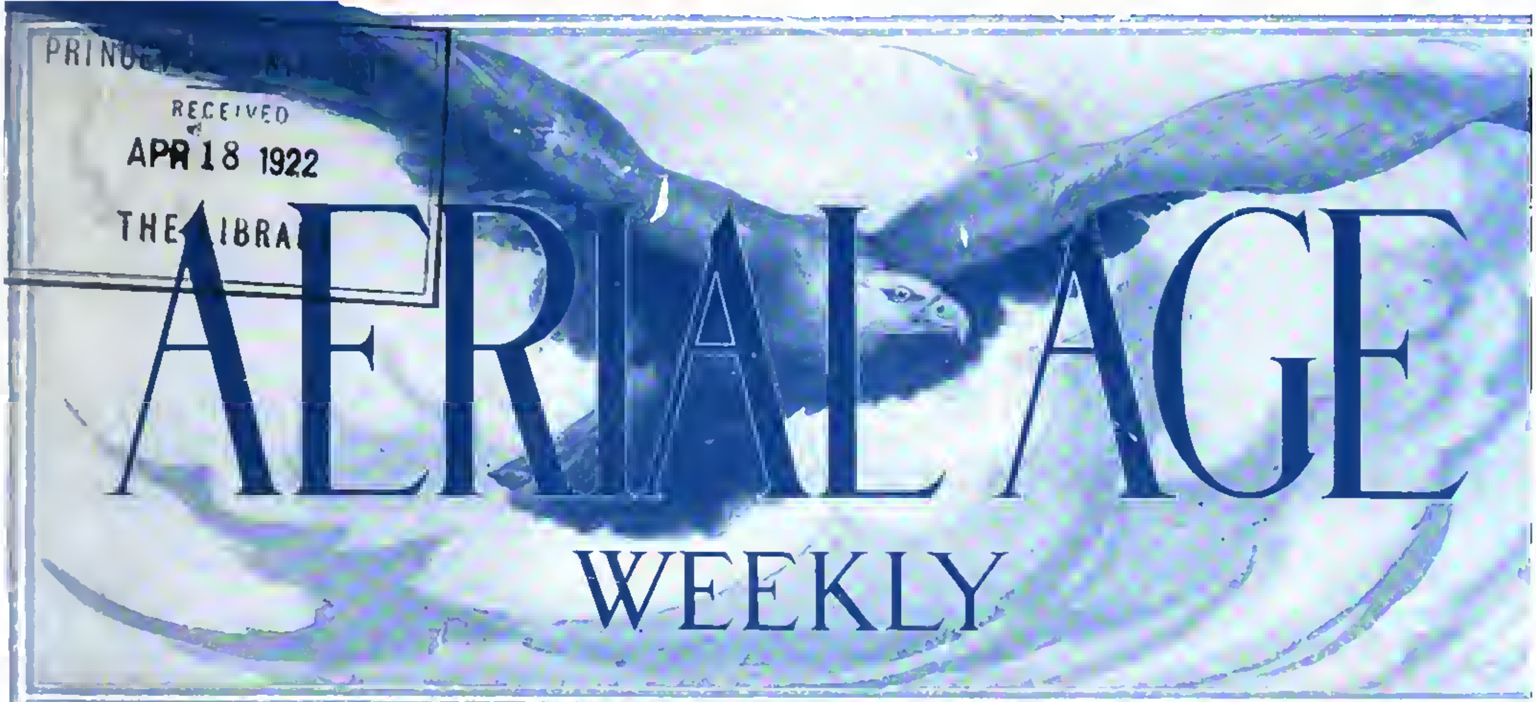

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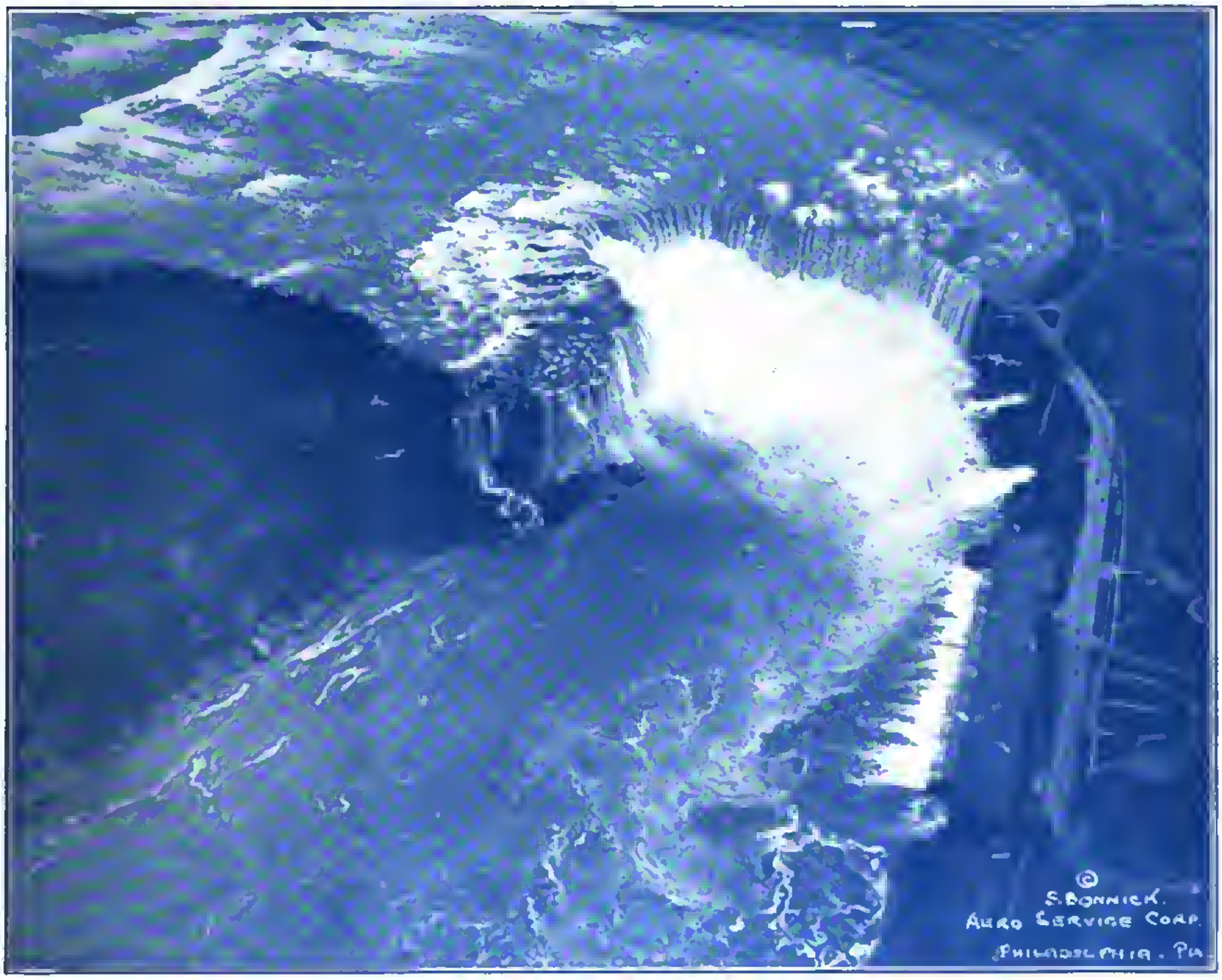

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Vol. XV, No. 6

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THE NATIONAL
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With which Flying *is consolidated*

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An Air Force Academy Suggested

CREATION of a United States Aeronautical Academy, to be to the air service what West Point is to the army and Annapolis to the navy, is contemplated in a resolution introduced April 3rd by Senator Walsh of Massachusetts. The resolution directs the Secretaries of War and the Navy to investigate and report to Congress on the advisability of establishing such institution.

"Immediate and adequate development of the science of aeronautics," said Mr. Walsh, "is vital to the protection and prosperity of the country. Aviation is now recognized as a dominant factor in relation to future transportation as well as to the national defense. It is a matter we cannot permit to sleep.

"As the Conference for the Limitation of Armament took no action to reduce, limit or control aviation, so far as its use in war is concerned, it should be apparent to the most casual observer that a sufficient and properly trained personnel, capable of developing, instructing and directing the aviation activities of the nation is important.

"If this country is not to be outdistanced in the field of aeronautics and thereby left defenseless, a separate school of aeronautics supported and controlled by the Government should be established."

Senator Walsh suggested that a part of West Point or of Annapolis or some navy yard be used for the Academy.

It is to be hoped that Senator Walsh's suggestion will have the attention which it merits.

A Saga by Wireless

IN their little skiffs the Norse vikings roamed the polar seas, and Scandinavian bards related their exploits in sagas. That was the style of reporting in those days. Now Roald Amundsen, twentieth century viking, equally at home in the cellar and on the roof of the world, expects to float to the North Pole in the good ship Maud, with casual side hops in a metal aeroplane, and he will send daily bulletins of all the Arctic news by radio. Sagas by wireless! It's the modern way.

Most polar expeditions are described as "dashes." Amundsen's trip will be more leisurely. The ice pack on which he is to drift has much to learn about rapid transit. Its timetable promises to deliver the explorer at the pole in three or may be five years. Yet he says there is enough of interest in the million square miles of uncharted surface to keep the ten members of the expedition busy every waking moment. He has high hopes of enriching the store of scientific knowledge and in particular of solving the mystery of the aurora borealis.

Of major interest in the enterprise is the auxiliary use of the aeroplane. It will be the first real test of the feasibility of aerial reconnoissance in the Arctic regions.

—Editorial in N. Y. Tribune.

Aviation—First Line in War

AVIATION has taken a sudden jump to the front as a recognized and invaluable agency in war. When the British government, which has always, and very rightly, in the past considered its navy as the first line of national defense voluntarily renounces this theory and admits that the conditions in 1922 have forced the conclusion that air forces have displaced both the army and navy as the dominating element in the protection of the British Empire we may well take notice—conservatism in the United States must awake from its stupor, and permit intelligence to control our military and naval policies.

Admiral Fisher and Sir Percy Scott, of the British navy, long ago foretold the reign of air power in war, but their warnings were little heeded by the controlling minds in the House of Commons until recently, when Austen Chamberlain raised the question in debate as to "what extent developments in aviation may render naval warfare more obsolete."

Mr. Chamberlain said "he could imagine circumstances might soon lead the world to believe that limitation of battleships or armaments would be of little use unless similar limitation was placed on air craft. . . . Believing as the government did, that the air force had immense potentialities, quite distinct from its duties as an adjunct to the naval and military service, and convinced that in the future the greatest danger to Great Britain might well be from an action by air forces, the government considered it would be a retrograde step to abolish the air ministry and reabsorb the air force into the Admiralty and War Office."

In conclusion Mr. Chamberlain declared: "In case of air raids the army and navy must play a secondary role, but in case of military or naval operations the air force must be in strict subordination to the general or admiral in supreme command."

These astonishing admissions on the part of the British government are justified—in fact, their soundness is conclusively demonstrated by recent happenings. It will be recalled that the Spaniards have used bombing planes to dislodge and demoralize the Moors when other weapons failed, thus saving their battalions from decimation by frontal attacks against a determined enemy. General Smuts employed bombing planes with similar effect against the rebels in South Africa, who were quite unprepared and helpless against this form of attack.

And now we are informed that "the possibility of effectively controlling a troublous country by means of an 'air army' is to be thoroughly tried out by the British in Mesopotamia."

Winston Churchill has taken the lead in this enterprise. "A fleet of 150 troop-carrying planes is under construction, each capable of carrying ten soldiers fully equipped, together with two machine guns and ammunition. By this means a complete battalion of 1,000 men can be transported hundreds of

(Concluded on page 142)

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THE NEWS OF THE WEEK

U. S. S. Langley Commissioned as Airplane Carrier

Norfolk, Va.—The U. S. S. Langley, airplane carrier, has been commissioned at the Norfolk Navy Yard. The ship was turned over to the Navy by the Navy Yard, and Commander Kenneth Whiting has assumed command of the vessel until her commander shall have been appointed. Commander Whiting will remain on board the ship as executive officer at all times, however.

Commander G. de C. Chevalier, U. S. N., will be given complete charge over all aviation activities aboard the vessel. He will come under the captain and executive officers, but he will have entire command of all the movements of the aviators and their craft, on the ship.

The commissioning of the ship was ceremonious, since the *Langley* is the first of her kind to be commissioned in the United States Navy.

Several hundred men, including architects and mechanics of nearly all the trades, have been employed in making the former collier *Jupiter* a complete airplane station afloat. Incident to her being a "harbor" for aircraft, the*Langley* will be one of the most peculiar looking ships on the seas. The thing in her build, which makes her radically different from other ships, is her landing deck. That deck is an immense platform, mounted above her main deck on trussed towers. Only by standing on that great platform can its proportions be appreciated. One is impressed with the feeling of standing on a field, so large is the deck.

Deep down in her hold has been stored quantities of chain and concrete, which will serve as ballast. Above this invaluable "cargo" and in the forward part of the vessel will be installed a complete shop for the repair of all kinds of aircraft. With the proposed machinery in her hold, and a capable crew, it will be possible to construct a plane almost completely aboard the vessel.

The *Langley* is 525 feet long and 65 feet beam, and she is driven by motors with a total horsepower of 5,500. She is said to attain a speed of 14 knots. The ship was built at Mare Island Navy Yard in 1912. Later, when the value of a ship of the type she now is was realized, the Navy Department turned the vessel, then a collier, over to the Navy Yard here, where she has undergone building changes for two years. The ship, although commissioned, is not completed. More months must elapse before she can steam out on her trial trip.

During the World War, aviation made a remarkable advance. In naval circles especially has the value of aircraft been realized. A home had to be provided for the "wasps," and it fell to the lot of the *Jupiter* to be converted.

Her name was changed to honor a pioneer of aviation, Langley, the man who was laughed to ridicule and whom Congress refused to grant money for the perfection of his airplane models because they were "impractical." He is now to be immortalized by a ship on the seas.

The ship is not quite completed. Before she will be ready for service her equipment must be installed. That one word "equipment" will include the only complete aviation repair and construction shop afloat.

Other additions to the strange vessel will be made in due time and all work is expected to be completed by May 1.

Flying Club of St. Louis

The Flying Club of St. Louis has established a flying field and club house eight miles from the city limits on the Natural Bridge Road. This field is northwest of St. Louis and situated on the Wabash Railroad at Anglum, Mo. It can be distinguished from the air principally by the hangar and a large grain elevator. No charge is made for the use of the field and space for hangars is provided free of charge.

The club is planning to organize a reserve unit for both lighter and heavier than air, and will cooperate with Scott Field, where at present the Air Service is constructing a large steel hangar for dirigibles.

The Advisory Board of the Flying Club is as follows: Albert B. Lambert, Chairman; Sam D. Capen, L. D. Dozier, F. W. A. Vesper, Ed. T. Hall, Frank C. Rand, Fred H. Semple, Col. A. T. Perkins, Harry B. Wallace, Robt. T. Morton, James M. Hranciscus, W. C. D'Arcy, Jesse McDonald, Geo. P. Dorris, M. W. Hayes.

Personal Par

M. A. C. Johnson, of Akron and Troy C. Williams, of Augusta, are barnstorming Georgia, North and South Carolina in a Standard-Curtiss.

W. B. A. C. Progress

The World's Board of Aeronautical Commissioners is making rapid strides in its membership campaign in the United States. There are 1937 nominated for membership, 2884 counties out of 3048 are represented by acceptances of state nominees, and 8088 cities and towns represented by acceptances of county nominees. Ninety-four countries and colonies are now represented by 111 commissioners.

Plan Airship Service England to Australia

London—A proposal for the formation of a company with a capital of £4,000,000 to start a mail and passenger airship service between England, India and Australia has been laid before the Government.

A powerful financial syndicate has offered to take over the British airship fleet which was due to be consigned to the Disposal Board. No capital investment by the Government is required, but there is a contingent liability in the form of a guarantee of interest and dividends of £91,000 a year from the State.

Messrs, Vickers, Limited have undertaken to subscribe for 100,000 shares at par and the Shell groups for 100,000 ordinary shares or debentures at par. Both companies will give full technical assistance.

The total contingent yearly subsidy in the form of a guarantee of a dividend on the ordinary shares and interest on the debentures (on the capital now proposed to be issued) would be on £1,200,000 ordinary shares, £72,000 for ten years. On £2,200,000 debentures, £990,000 until redemption. Dividing the subsidy among the countries which would obtain the benefit of airship service the cost would be: Britain, £91,000 a year; Australia, £40,000 a year, and India, £40,000 a year. These dividend and interest payments would cease as soon as profits from the company were sufficient to pay them.

The program of development has been divided into two stages—a bi-weekly service to India and an alternate day service to India with weekly extension to Australia.

The Government is asked to transfer to the company free of cost all airships, airship material and airship bases and supply wireless telegraphy and meteorological services.

If the scheme is approved, it is claimed the airship passengers from England would reach Bombay in five and a half days, Rangoon in seven and a half days, Hongkong in eight and a half days and Australia in eleven and a half days.

The new ships will be capable of carrying a hundred passengers and eight to ten tons of mail, and will have a cruising speed of sixty miles an hour.

Attacks Navy Air Exams.

Washington—Senator Walsh told the Senate Naval Affairs Committee on April 6 that "unjust examinations" are driving 500 Naval Reserve airmen, among them some of the best in the service, back into private life. The Massachusetts Senator suggested that the committee ask the Navy Department to correct what he described as "a deplorable situation." Some of the most efficient and experienced air officers were being forced out, the Senator said, by "trick" examinations.

"These men are trained in the science of aviation over a period of years and then called upon to pass examinations involving navigation, steam engineering and other subjects with which they, in the very nature of their work, are not familiar," the Senator continued.

"I will show that there is discrimination in the navy between the boy from the ranks who wins his commission through hard work and on his merits and the boy who goes through Annapolis. The aviation arm is one that cannot be trifled with in any efficiently organized modern navy."

Efforts of certain old-time officers who, he said, were opposed to the naval aviation program were another handicap to proper development of navy aviation, said Senator Walsh.

COMING AERONAUTICAL EVENTS

AMERICAN

Apr. 30.	—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
May	—National Balloon Race.
Sept. 4. (*about*)	—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
Sept. 15. (*about*)	—Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)
Sept. 30.	—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1. (*about*)	—Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Venice.
Aug. 6.	—Gordon Bennett Balloon Race, Geneva, Switzerland.
Oct. 1.	—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

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Detroit-Cleveland Airline

Eddie Stinson, holder of the world's endurance record, who recently purchased a number of Junkers monoplanes from the Government, is now in Detroit having the machines overhauled at the Stout Engineering Laboratories, and when the changes have been completed a line will be established between Detroit and Cleveland. It is planned to make eight trips a day.

Stinson is having one machine especially equipped for long distance work, and this summer he will attempt a non-stop flight from San Francisco to New York, and he is thoroughly confident he will be successful. Stinson is one of the most experiences fliers in America, and his many friends throughout the country are congratulating him on his new enterprise and wishing for him the utmost success.

Curtiss Employees Fly to Keep in Practice

Through the efforts of Mr. Theodore Wright, Executive Engineer of the Curtiss Aeroplane and Motor Corporation at Garden City, employees of the company who were formerly pilots, are allowed the use of a JN aeroplane for practice flights. Mr. Wright, who was a naval flying officer, and several other members of the engineering department formerly in the flying service, are able to keep up their practice by this arrangement with the Curtiss officials.

Pilot C. S (Casey) Jones is supervisor of flights, which are now made on Saturday afternoons, Sundays and holidays, but with the coming of "daylight saving" time, opportunity will be had for flights in the early evening. At present, the pilots now elegible for practice flying are: Theodore Wrigbt, C. A. Koch, S. Joseph, E. E. Tatersfield, V. Higbie and John H. De Mott. Mr. H. Ogden, employed in the engineering department, is progressing rapidly in the art of flying, under the instruction of "Casey" Jones.

The Curtiss Company recognizes the value of trained flyers in its organization and encourages their work in a practical manner.

Personal Par

Mr. Grover C. Loening, President of the Loening Aeronautical Engineering Corporation was recently operated on for appendicitis at the Knickerbocker Hospital by Doctor D. W. Martin, Chief Surgeon of St. Luke's Hospital.

The attack was very sudden, but the operation was entirely successful. Mr. Loening has now left the hospital and is expected to be back at his work in a week or ten days.

Wallace Field News

A busy season is looked for at Wallace Field. An innovation there this year will be an Airplane Filling Station, where filtered high test gas will be supplied to flyers from a ten-barrel underground tank, with pump rigged high enough for its 16-foot hose to reach the gas tanks of any ships and fill them almost instantaneously.

J. Wesley Smith has joined Frank Wallace's corps of flyers, and companies operating from the field will include:

The Carlson Aviation Company.

The Aircraft Service and Sales Company.

The Fred Brown Repair Company.

Wallace Field is registered, contains 103 acres, and is open to the use of all flyers. It is located on the Mississippi, just above Davenport—a "town with eyes on the top of its head."

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, February 1922

DIVISION	Gas	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchman	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gas	Total Time Run Hr.	Total Time Run Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	$3,190.91	$588.82	$4,060.87	$2,841.43	$842.89	$1,120.20	$3,301.38	$1,488.74	$4,189.31	$2,944.61	$1,709.19	$784.78	$27,063.13	10,649	384	30	36,341	$70.38	$0.74
CENTRAL Chicago-Rock Springs.	4,140.48	890.95	3,708.49	2,209.54	808.10	1,151.95	3,574.72	2,156.10	5,389.80	4,994.79	2,475.37	1,136.58	32,636.87	14,982	576	11	52,101	56.66	.63
WESTERN Rock Springs-San Francisco	2,668.15	469.82	5,873.29	1,663.24	1,105.94	690.44	3,549.69	1,488.74	3,759.66	3,435.35	1,709.19	784.78	27,198.29	8,712	314	17	29,642	86.54	.92
Totals and Averages.....	$9,999.54	$1,949.59	$13,642.65	$6,714.21	$2,756.93	$2,962.59	$10,425.79	$5,133.58	$13,338.77	$11,374.75	$5,893.75	$2,706.14	$86,898.29	34,343	1,274	58	118,084	$68.15	$0.74

Total Operating Cost................................	$86,898.29
Permanent Improvements..........................	4,658.59
Grand Total..............................	$91,556.88

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern........................	$0.21	$0.22	$0.31
Central........................	.18	.20	.25
Western........................	.27	.23	.42
Entire Service.................	$0.21	$0.22	$0.31

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.
Flying consists of: Gas; Grease and Oil; Pilots.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

E.R. WHITE, Acting Second Assistant Postmaster General.

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AERONAUTIC CHARTS

By STORY B. LADD

THE chart is for the guidance of aviators, so that an operator can lay his course direct for his objective point and can, en route, check and correct his course for air drift.

The underlying principal is the subdivision of the continental areas into blocks, and the installation of markers at the intersection of block lines which, by reason of their shape, contour, or distinguisbing features, as viewed from above, will indicate to the observer the geographic position of the market.

It is not proposed to post the entire country, nor any portion thereof, by the installation of markers at all points, but to provide a system which can be added to or differentiated as the growth of air travel requires, and whenever or wherever a marker is installed, whether under national or state auspices, by Aero Clubs, Chambers of Commerce, or other organizations, it will be in harmony with the general plan, and become a part of the continental system.

The blocks are spherical quadrilaterals, laid out on lines of latitude and longitude, and the term as here used refers to an area bounded on the east and west by north and south lines, and on the north and south by east and west lines; by meridians of longitude and parallels of latitude, respectively.

The term "marker" refers to a device or structure, preferably erected so as to stand above other objects in the neighborbood and be distinguishable at a distance.

It is important that the system, in its growth and development, be continental in its scope, without breaks at national or state bounderies, and that all markers, wherever installed, shall be alike in character and significance, and speak the same language to the aviator. In this presentation it is described as applicable to a world system.

Eight degrees, of longitude and latitude, has been taken for the major blocks, these to be subdivided into quarter sections, and the quarter sections into quarter blocks, giving, as a result, 16 quadrilaterals, 2° by 2°, these being referred to as intermediate blocks. These intermediate blocks are in like manner subdivided into quadrilaterals of 24' by 24' making 25 subdivisions. These are the minor block units, and each marker that is installed identifies a minor block.

With major blocks of 8° standard for all countries, the major blocks in the equatorial zone will be approximately 550 miles square with intermediates (2°x2°) of 138 miles, and minor blocks (24'x24') of 27.6 miles. Going north and south from the equator, the distances along meridional lines will be constant, witb the distances along parallels of latitude gradually diminishing. At the 40th parallel, the east and west dimension for the major blocks will be approximately 428 miles; for intermediates, 107 miles; and for minor blocks, 21.4 miles. At the 50th parallel of latitude, these distances will be approximately 360 miles, 90 miles, and 18 miles, respectively: and at 60°, 280 miles, 70 miles, and 14 miles.

The subdivisions of the intermediate blocks may be 36 in number, 6 in a tier, each 20'x20', or even 64 in number, 8 in a tier, each 15'x15', if the markers on the basis here outlined are too far apart, but it is thought provision for shorter intervals, when desirable, can be best met by midblock markers at half intervals.

For purposes of identification, the intermediate blocks are lettered *A* to *P*, beginning at the northwest corner of a major block and in quarter section groups, the letters *A*, *B*, *C*, and *D* indicating the four intermediate blocks of the northwest quarter section; *E*, *F*, *G*, and *H* those of the northeast quarter section; *I*, *J*, *K*, and *L* the southwest quarter section; and *M*, *N*, *O*, and *P* the southeast.

The major blocks are to be cited by the longitude and latitude of the northwest corner of the block, and as all major blocks are 8° in dimensions these numbers are always multiples of 8, longitude being placed first. Thus "104-48" identifies a block bounded by meridans 98° and 104° (in the western hemisphere) and by parallels of lattitude 40° and 48° (in the nortbern hemisphere); and "104-32" identifies the major block covering southern Texas and a portion of Mexico. If there is any question as to the quarter of the globe, designating letters will precede the numbers. In tbis event, the above noted blocks will be designated "N. W. 104-48" and "N. W. 104-32." "N. E. 40-48" is a block covering parts of Southern Rnssia and tbe Caucasus; "S. E. 16-24" (still using the northwest corner for blocks in the southern hemisphere) the Soutb African Union; and "S. W. 64-32" portions of Argentina and Uruguay.

The letter designation of the intermediate block follows the major block designation—thus "N. W. 104-48 C" indicates the intermediate block *C* in a major block, the northwest corner of which is 104° west longitude, and 48° north latitude.

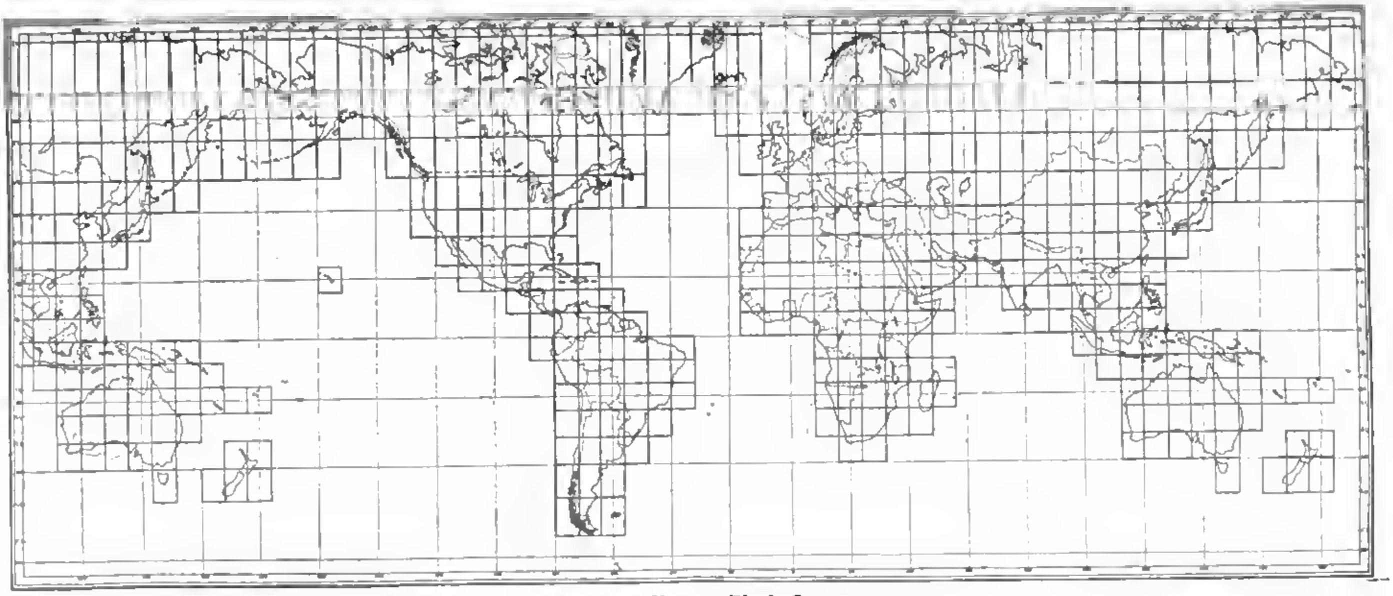
The minor blocks are identified by numbers 1 to 25, beginning at the northwest corner of the intermediate block. These are the marker numbers. In designating a minor block, the number follows the intermediate block letter, thus "104-48 C 10" identifies a specific location (the marker may or may not have been installed) in block "104-48 C."

Markers.—The markers are platform structures, carried by skeleton towers, high enough to clear surrounding objects, and in forest and timbered districts to show above the trees. In open country an elevation sufficient to be out of the way of cattle and drifting snows will suffice.

In mountain or broken country where the true location of a marker comes in a ravine or valley, or where it would not be visible from a distance, it will be located at the nearest available point, the offset showing on the charts.

The contour of the platform is the dis-

1) See "Aerial Age", of Aug. 22, t92t and Dec. 26, t92t.



Aeronautic Charts—Block System

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tinctive feature of a marker that identifies the intermediate block in which it is located, and it is desirable that the distinctive shapes be as few and simple as possible. To this end the shapes recommended are four in number, circular, square, triangular, and a trefoil. In this connection, the effect of foreshortening is to be borne in mind, a circle appearing as an ellipse and a square as a diamond or a rectangle. All markers within an intermediate block are to be of the same contour. The shape of the platform as viewed from above identifies the intermediate block, and the four shapes suffice for the four intermediates that form a quarter section of a major block.

It is necessary that the visibility of the markers be preserved under snow conditions when the ground and the platforms are white with snow. For this purpose the platforms are made with a skirt around the outer rim, sloping outward at a steep angle and painted black. From above this rim skirt will appear as a black line outlining the edge of the marker. Snow may adhere thereto to some extent on the windward side, after a storm, but sufficient portions will be exposed to catch the eye of the aviator.

The quarter section is preferably to be indicated by an adjumct that will not confuse the platform contour, but which can be readily interpreted, and in a prior presentation of the project the markets were to be provided with an arm projecting to the northwest, the northeast, the southwest or the southeast, as the case might be. An arm extending out from the rim of the marker will detract from the distinctiveness of the contour and may be confusing to the observer, and moreover he might be in doubt as to the compass direction in which the arm was pointing. It is therefore proposed that the quarter section be indicated by one or more discs, separate and detached from the marker platform, but carried by the platform structure on a level with the platform. The position of these discs with respect to the platform is not material; but for uniformity and in order than an aviator may know where to look for them, they are on the south side of the platform. They may be truncated cones, with black slopes, far enough removed from the platform so that under snow conditions the space between a disc and the platform will not be bridged by the snow and the outline of the platform broken. One disc will signify the first or northwest quarter of the major block, two discs the second or northeast quarter, three the southwest quarter, and four the southeast quarter. The scheme may provide for one, two, or three discs, for the second, third, and fourth quarters respectively, the absence of a disc signifying the first quarter. In the event, however, of an aviator not noting the presence of a disc or discs, he would interpret the marker as being in the first quarter; whereas if all markers carry a disc or discs, he will always look therefor and will not miss the correct interpretation.

The combination of the four contours and the discs provides for tbe ready identification of any one of the 16 intermediate blocks without recourse on the part of the observer to compass directions.

With respect to the major blocks, which represent areas of 200,000 to 300,000 square miles, it is assumed that no marker feature is necessary. An aviator will know his position as between eastern Massachusetts or Ohio, Central Illinois or southern Alabama, the north of France or Spain. With knowledge of the marker shape and the number of accompanying discs, which will appear as dots or spots contiguous to the platform, he at once knows bis position within 2 degrees.

The minor block units are indicated by numbers from 1 to 25, showing in the center of the markers. The number is placed to be read from the south and appears separate and detached from the surrounding platform in the middle of an open central field. The space between the number and the edge of the surrounding platform will be sufficient, in northern districts, to bar the formation of a snow bridge. To maintain the visibility of the numbers under snow conditions, they can be made of hipped lines of steep slopes, and painted black. Though in winter, in some districts, a marker may carry a heavy snow blanket, there will be open space around the number and the lines will be sufficiently exposed to be decipherable. An aviator may not be able to read the number from a considerable elevation or distance, but if knowledge of the intermediate block from the marker contour is not sufficient, he will approach near enough to decipher the number.

At the distances between markers called for by the foregoing, an aviator, when following a posted route, will pass beyond view of a rear marker before he catches a glimpse of the one ahead. Under normal conditions a marker can probably be seen at a distance of 5 or 6 miles. But he will come within view of the forward marker before he can have materially deviated from his course. In a cross flight, however, he may cross a posted line at a midway point and out of sight of a marker. It may therefore be desirable to install markers at such intervals that in a cross flight a marker will be within range of view regardless of where the poster route is crossed. It is proposed to meet this requirement when necessary, by intermediate markers located on the line midway of the minor block corners. They can carry the distinguishing features of contour and disc or discs, called for by the block, and if more exact information is desirable the number with the addition of a short "dash" after the number within the central open field, if the marker is on an east and west line, or below the number, within the central open field, if the marker is on a north and south line. Thus twelve will signify that the marker is located at a half-way point between locations "12" and "13" of the intermediate block, and twelve that the marker is located at a half-way point between locations "12" and "17" of the intermediate block—"7" being the minor block south of "12." It will probably, however, be sufficient for the marker to show only the block contour, for if more exact information is desired tbe aviator will turn aside and look for the next marker on the line.

Inside markers. A marker located within the confines of a minor block, for example in proximity to a landing field, can show the indicia called for by that minor block with the addition of an inside ring around the number and a narrow annular open space between the ring and the platform. This will signify that the marker is within the area of the block, the position of same being shown on the chart for that district.

Frontiers. At the frontier crossing on a postal route, the boundary line can be marked by a split platform of the contour called for by the intermediate block but without the number, the platform being divided by a central gap conforming in direction to the boundary line.

Notice of installations. As installations are made, the locations will be published as items of general news and the aviators will mark the locations on their charts. This publication will call simply for the longitude and latitude designations of the major block, tbe intermediate block letter, and the minor block number. In the case of a marker that is off the true location, its position will be given by coordinates with respect to the block corner; as, for example, when because of the topography of the country, "104-40 D 8" is erected "2 miles north and 3 miles east" of the northwest corner of said clock.

Duplicate markers. If a continental route is posted on an unbroken east and west, or north and south line, there will be a duplication of the markers in the major blocks traversed. For example, if a due east and west transcontinental line is posted from Georgia to California, the series of markers in blocks "80-40," "88-40," "96-40," "104-40," "120-40," and "128-40" will be duplications. This can be avoided, in laying out the line, by offsets between major blocks. If at the junction of "80-40" and "88-40" the line is sidestepped to the next tier of minor blocks, say to the north, it will strike a different series of marker numbers. Then crossing to "96-40" let there be another offset and likewise with each successive block. There will then be no duplications on the entire route. The same course can be followed with respect to north and south posted lines.

Urban and Industrial Districts. A cordon of markers surrounding an industrial district will give an aviator his bearings from whatever direction he approaches. Knowing the longitude and latitude of a point within a district, the block locations, and the proper contour, quarter-section designation and numbers are readily determinable.

Direct routes. The posting of direct routes between points can readily be done in the initiation of the project by installing the markers along the lines of travel at the points called for by the system. Many of these will be at varying distances to the right or left of the line but within view, and where the line of travel crosses a block line at a point some distance removed from a block corner, a midline marker can be installed, as above indicated.

Night travel. For night service on a route where there is regular travel, the markers will be equipped with lights under radio control so that an aircraft, with radio control can, at will, cut in the lights within range, and lights will be on only as needed.

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SEVENTH CORPS AREA COMMERCIAL AERONAUTICAL ASSOCIATION ORGANIZED

By R. TAYLOR

Special Correspondent of the Aerial Age

THE Commercial Aeronautical Association of the Seventh Army Corps Area, the first of its kind in the United States, was organized by business men of the area and others interested in aviation at the canvention in Sioux City, Ia., March 27, 28 and 29. This marks the first organized effort in America toward establishment of a commercial air transportation system, and will be followed by similar action in the other eight corps areas, the intention being to ultimately inaugurate a transcontinental air system.

The constitution of the new organization includes provisions for the development of aeronautics both commercially and scientifically; establishment of uniform landing fields in the fifty-nine leading cities of the area; co-operation with other corps areas in promoting a transcontinental system, and cooperation with the war and navy departments in the matter of aerial defense.

The seventh area organization will seek to become a part of the Aeronautical Association of the United States of America, following perfection of the national association at the convention in Detroit in September.

Support of the air mail service and the early passage of the Wadsworth-Hicks bill was advocated in resolutions passed by the convention.

All cities and towns of the Seventh army corps area, which includes Arkansas, Missouri, Nebraska, Iowa, North Dakota, South Dakota, Minnesota and Kansas, will be invited to become members through their aeronautical clubs or chambers of commerce, according to the tentative agreements made at the convention. The corps area organization also will accept personal memberships at $5 each. Local organizations must have not fewer than 25 persons in order to gain admittance to the association.

Cities of 10,000 or under would be represented by one vote in the corps organization, and one delegate for each additional 10,000 of population would be added, according to plans of the officers.

It is planned to divide the cities into three classes. First class cities will be those of 50,000 or more in population; second class, between 12,000 and 50,000, and third class, 12,000 or under.

Requirements of first class cities include possession of a first class landing field; hangar facilities for at least six commercial air craft; repair hangars to care for two planes at a time; oil and gas filling stations; identification markers complying with international rules; a field superintendent on duty at all times, and the location of the field to be convenient for surface transportation.

Cities of class two would need hangar facilities for three ships; emergency repair shops; gas and oil supplies; identification markers; wind zones, and telephone and wireless equipment. Cities of the third class would be known as an emergency landing place, and would be required to have a field, the size and type of which would change according to service required.

Assisting the Seventh district delegates in the organization scheme were Rear Admiral W. F. Fullam, former commander of the naval air forces, and Brigadier General W. L. Kenly, former commander of the air forces in France, both acting as advisors.

The use of lighter than air craft for commercial air transportation is a certainty of the future, declared General Kenly in his addess to the delegates.

"Because of the Roma and Z R-2 disasters there is no reason why lighter than air craft cannot be developed," said General Kenly. "Lighter than air craft is coming, as sure as life. The public at present knows heavier than air machines, but is not acquainted with dirigible baloons. However, the need of lighter than air craft will be felt in the inauguration of an extensive commercial system.

"This country has practically a monopoly on helium. I believe helium can be produced on a commercial basis and at a comparatively low figure.

"Two years ago, a board of engineers representing the American Investigating Corporation went abroad to probe development of lighter than air machines. After a year of investigation, during which they visited England, France, Germany and Italy, the engineers reported the project was feasible commercially. They found the Germans far ahead of the other countries in the development of lighter than air craft.

"One of the results of this report has been tbe formation of the General Air Service. This firm has acquired certain rights on German inventions in the lighter than air machines and now is devoting its attention to the possibilities of commercial helium.

"With helium and properly constructed machines we can travel anywhere with perfect safety. But there also will be further opportunities for heavier than air craft. When the great lighter than air machines are working on established routes, the heavier than air machines could be used to good advantage in forming quick 'feeders.'"

A paper by Samuel S. Bradley, general manager of the Aeronautical Chamber of Commerce, and read by J. B. Harvey, Kansas City delegate, pointed out the growth of aeronautics in the United States in 1921.

"We estimate, from reports received by the Aeronautical Chamber of Commerce, that there was about 20 per cent more flying in the Unitd States in 1921 than during the previous year," said Mr. Bradley's paper. "This is a remarkable fact when one recalls the general business and industrial depression.

"The public has changed its mind in regard to flying. A year ago many persons believed that the present generation, which witnessed the development of the motor car, wireless and other astounding inventions, would not accept the flying machine. It was a bit too much to expect of a race that had always kept one foot on the ground, so to speak. Nevertheless, the aeroplane has been accepted.

"The general opinion prevails throughout the industry that the public has been shown and that it now is up to the public to make use of the flying machine for what it is worth. Then, let us hope to find another 20 per cent increase in flying at the end of this year.

"Half of the aeronautical activities of 1921 were carried on in the region between the Appalachian and the Rocky Mountains. Half the aeroplanes in the country are operated there. The Mississippi, Ohio and Missouri River Valleys, Colorado, Montana, the Dakotas, Iowa, Nebraska, Oklahoma and Texas afford many natural advantages, chief among them, emergency landing facilities. It is estimated that more than 300 planes were entered in flying meets in the Middle West in 1921, and that they flew a total of 500,000 miles in these meets, carrying approximately 15,000 passengers before the crowds aggregating 400,000 spectators.

"Now it is up to us, or rather, to the government, to protect commercial aviation. We must protect people and property, in flight and upon the earth, against damage, loss or nuisance from aircraft. In other words, we must secure adequate control of flight, but in a manner that will not throttle development. The problem is civilian because it pertains to commerce and industry. At the same time it is intimately connected with national defense. The Wadsworth-Hicks bill should be made a law before spring flying opens. With air laws will come capital and individual responsibility."

The science of flying in the future will be so advanced both as regards lighter than air craft and heavier than air machines that there will be intimate and general communication between all cities and towns of the country by means of aircraft, it was predicted in an address by Admiral Fullam.

"This aircraft communication will involve a transportation of mail, passengers, and, to a certain extent, freight, between communities and different sections of the country," said Admiral Fullam. "It is believed, therefore, that the organization of the Commercial Aeronautical Association of the Seventh Army Corps Area in Sioux City is a movement that will ultimately be of great benefit to every town and city that joins in the movement. It is the dawn of a new era in transportation which will benefit all business interests.

"It is clear that in a few years the enormous and expensive battleships of the present day will be so completely at the mercy of air attack, combined with submarine attack and mines and torpedoes that no more ships of this type will be built after the ten-year naval holiday. Of all these new weapons it is believed that the air forces are the most important, for with these alone a nation can absolutely protect itself from naval raids and from invasion by armies overseas.

"No fleet and no convoy can bring with them across the sea sufficient air forces to command the air after they reach our coast, provided this country supplies itself with strong air forces for the use of the army and navy. In this con-

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nection commercial aviation, involving the use of both heavier than air and lighter than air machines is of the most vital importance to our country, because all such forces, with their personnel, could be rallied as a reserve in time of war.

"It is my belief that aviation has great practical uses and that safety in flying has been secured to such an extent that we may discount all fear as to the dangers involved. In Europe, men of big interests are flying all over the continent to keep their dinner engagements. Lighter than air craft development will unquestionably be recognized soon as a safe and reliable means of transportation."

The following officers were elected for the Seventh corps organization: Ralph W. Crum, Davenport, Ia., president; M. F. Stack, St. Louis, first vice-president; J. B. Harvey, Kansas City, second vice-president; W. B. Swaney, Fort Dodge, Ia., third vice-president; John W. Coleman, Sioux City, secretary, and C. H. Wolfley, St. Joseph, Mo., treasurer, The board of directors will consist of the officers and E. R. Schultz, Sioux City; J. L. McNeill, Des Moines, and A. R. Dunphy, Omaha.

The office of the secretary, John W. Coleman, is located at 315 Metropolitan Building, Sioux City.

THE BELGIAN PLAN OF SUBSIDIES FOR AIR TRANSPORT COMPANIES

Subsidies

SUBSIDIES are of two kinds:

(1) Subsidies based upon the hours of flight and the distance covered.

(2) Commercial efficiency subsidies proportional to the gross receipts.

The subsidies under (1) comprise:

(a) An amortization subsidy;

(b) A course subsidy.

The amortization subsidy is determined by the formula $\frac{P + 1.5\ p}{200}$ where P represents the value of the cellule (in francs) and p the value of the engine group (in francs,) each increased by 20 % to include the costs of upkeep and insurance.

The value of the cellule and engine group is fixed by the Technical Commission of the Administration of Civil Aeronautics at the time of the proposal of the Service.

The course subsidy is determined by the formula $\frac{K}{1000} \times V^2 \times 1.5\ T$, where V represents the speed, T the useful load and K a variable. The speed V is measured in kilometers per hour at 2,000 meters. T is the load in tons after the following have been deducted:

(a) The weight of the crew (computed at 80 kg. per person.)

(b) The weight of the navigation instruments.

(c) The weight of the fuel.

The load factor of the aeroplane must be at least 5.

The practical ceiling (height attained after one hour of flight) must be at least 4,000 meters with full load.

The aeroplane must be able to cover a course of 500 kilometers with a contrary wind of 10 meters per second, admitting that the speed of the aeroplane is its speed at 2,000 meters and that the consumption of the engine is that taken on the ground and at full power.

The value of K is fixed as follows:

Mean length of Course (in kilometers)	200	201 300	301 400	401 500	501 600	601 700
In Belgium............	3	4	5			
International..........	4	5	6	7	8	9

The number of hours of flight subsidized is calculated by following the itinerary determined at a fixed speed of 130 k. p. h. The course will be measured in a straight line from the point of departure to the point of arrival unless an obligatory itinerary is fixed by international agreements or national rules. In these cases the course will be measured by the broken line which passes through the center of the airway imposed and which avoids the forbidden zone. Journeys will not be subsidized which are not completed or which exceed the normal duration by 50% (normal duration being the quotient obtained by dividing the distance D by the commercial speed of 130 k. p. h.) However, in the case of special atmospheric conditions properly noted and proved, complete journeys made with several stops may be subsidized when they have been made in a length of time showing a gain of at least 25% over the fastest means of public transport on land or sea.

Except in the case of "force majeure" properly noted by the Chief of the Aerodrome or his delegate and of which mention must be made in the log book, a delay in departure of ¼ of an hour incurs a reduction of 5% in the time subsidy. The same reduction applies to each ¼ hour or fraction thereof which follows.

The time subsidies fixed above can be increased or diminished according to the degree of punctuality attained. A coefficient of variation is established monthly as a function of the regularity of service. The regularity is defined by the proportion of the number of journeys subsidized to the number planned (extra authorized trips being excluded.) The coefficient of variation will be equal to the above proportion expressed in hundredths, increased for the months of December to March inclusive by 35/100 and for the other months by 25/100. The monthly total of the time subsidies to be paid is then multiplied by this coefficient, thus giving the net sum to be paid.

The amount of the commercial efficiency subsidies is in direct relation to the reduction made in the fares, and varies according to whether it concerns passenger or freight.

(a) *Subsidy for passengers.*

To benefit by this subsidy the passenger fare must not exceed 1.25 fr. per km. This subsidy is given according to the following method:

For all reductions of less than 10% from the fare of 1.25 fr. per km. a subsidy of 60% on the receipts is given.

For reductions of 10% to 19% inclusive, from 20% to 29%, from 30% to 39% and for 40% or more, subsidies of 90%, 120%, 150% and 180% respectively, are given on the receipts.

(b) *Freight subsidy.*

To receive this subsidy the charges for freight transport must not exceed 0.02 francs per kilogram per kilometer. The subsidy is calculated as follows:

Every reductions of less than 20% from the cost of 0.02 francs per kilogram per kilometer gives the right to a subsidy of 35% of the receipts.

Reductions of 20% to 29% inclusive, 30% to 39%, 40% to 49% and 50% or more are compensated by subsidies of 60%, 85%, 110% and 135%, respectively, of the receipts.

Conditions Required to Obtain Subsidies

(a) The Company must be Belgian.

(b) The capital of the Company must be at least equal to the amount of the annual subsidy which it will receive, supposing that all the journeys proposed are covered and taking into account only the time subsidy.

The capital will be represented either by buildings or material (the value of aeroplanes being that fixed by the Administration of Civil Aeronautics,) or by supplies or hangars (intended only for the proposed lines,) or by subscriptions of which the total payment may be required by the State.

The origin of the capital, all necessary information in regard to the shareholders and the names of the directors must be communicated to the Administration of Civil Aeronautics at the time of formation of the Company or on any change in it.

(c) The personnel directing the Company must be of Belgian nationality.

(d) The pilots and mechanics are to be in general of Belgian nationality. The employment of foreign pilots and mechanics will be authorized only in case of lack of Belgian personnel.

(e) The aeroplanes used must possess their navigation certificates and Belgian licenses.

(f) The pilots must be provided with the Belgain licenses as pilots for aeroplanes for public transport.

(g) The services which the Company proposes to effect must be of public or national interest and offer a great improvement over existing means of transport.

(h) In general no Company will be subsidized which does not maintain a daily service over Belgian territory or to foreign points if within 250 km. of the Belgian frontier. In the case of more distant points the service must be at least three times per week.

(i) The fares must be agreed to by the State.

(j) In case the Company should use private landing fields they must be acceptable to the Administration of Civil Aeronautics.

Obligations

The State requires a minimum number of aeroplanes, pilots and mechanics in the interests of regularity and safety of the services.

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The required minima are:

1. For aeroplanes. Twice the number of aeroplanes which will be used up during the operation of the service. The number is calculated by taking the life of the aeroplane as 200 flying hours and the speed as 30 k. p. h. The number of aeroplanes therefore will be the

daily course (in kms.) x number of days of operation.
200 x 130

Note: If a fraction is obtained, the number of aeroplanes required will be increased to the next whole number.

2. For pilots: half of the number of aeroplanes.

3. For mechanics: one for every 300 HP employed in the total number of aeroplanes.

The subsidized companies are required to equip their aeroplanes with all devices and arrangements to assure the public the maximum of safety and comfort and to carry out the orders of the State which may be made in this respect.

The subsidized companies are required to place their installations, material, and all their resources at the disposition of the State from the first day of mobilization of the Army, according to the plan of mobilization made in agreement with the Director of Aeronautics.

Penalties

If the regularity of service is not maintained owing to lack of personnel or material, poor organization or any other cause except "force majeure" and in the case of non-compliance with these regulations, the Director of the Administration of Civil Aeronautics may suspend the subsidy of the Company. In case of bad weather, departures may be delayed or suppressed by agreement between the representatives of the Government and the Company. The decision of the Government's representatives is final without, however, incurring the responsibility of the State.

If during three consecutive months the efficiency of the line drops below 25%, that is, if the total of paying passengers and freight carried is less than a quarter of the total available seats and load capacity the commercial efficiency subsidies will be suspended until the efficiency becomes more than 25%.

Non-compliance with the regulations contained herein entails the following penalties:

1. Warning.
2. Suspension of subsidies for one month.
3. Permanent suppression of subsidies.

Control

The control to which the companies are required to submit is of two kinds.

Technical control (bearing on the personnel and material employed.)

Administrative control.

Technical Control

This control is in the hands of a Technical Commission designated by the Administration of Civil Aeronautics and is made:

On presentation of proposal.

On starting the service.

During the course of the service.

(a) *On presentation of proposal.*

The companies must send to the Administration of Civil Aeronautics forms giving the state of the material and personnel.

The Technical Commission is to assure itself:

1. That the aeroplanes to be used by the Company possess their Certificates of Navigation and are in perfect flying condition.
2. That the special modifications do not decrease the worth of the aeroplanes.
3. That the aeroplanes can fulfill the conditions (length of flights, load carried, etc.)
4. That the pilots and mechanics possess the proper licenses.
5. That the private landing fields used by the Company are in proper condition.

(b) *On starting the service.*

The Technical Commission verifies the identity of the conditions at this time with those mentioned in the proposal.

(c) *During the course of the service.*

The services are required to submit the first of each month forms relating to the condition of the personnel and material.

On variable dates the Technical Commission notes whether the pilots, mechanics and aeroplanes continue to possess the necessary qualities.

Administrative Control

This control is made by the proper services of the Administration of Civil Aeronautics.

(a) On presentation of a proposal.
(b) On starting the service.
(c) During the course of the service.

(a) *On presentation of proposal.*

The control service is to assure itself:

1. That the Company is Belgian.
2. That the persons directing the enterprise are Belgian.
3. That the Company employs pilots and mechanics of foreign nationality only if Belgian pilots and mechanics are lacking.
4. That the Company possesses and will place in service the minimum number of pilots, mechanics and aeroplanes required by the State.
5. That the rates charged will not exceed those fixed by the State.

(b) *On starting the service.*

The control service verifies:

1. The agreement of the conditions of the starting of the service with those of the proposal.
2. Whether the aeroplanes have the proper Belgian licenses.

(c) *During the course of the service.*

The control service is to assure itself of the regularity of the service.

The Companies must send control forms to the Administration of Civil Aeronautics the 1st, 11th and 21st of each month.

In order to assure the execution of the article given above relating to penalties for delay in starting, a register will be kept in each aerodrome. The delays with their causes will be inscribed on a sheet signed by the Chief of Aerodrome and pilot or representative of the Company on the field.

To permit verification of the passengers and freight transported, the Companies must present to the Administration of Civil Aeronautics at the end of each month a resume of the passengers and freight carried during the month with the numbers of the tickets and luggage receipts as well as the prices of each.

At the time of arrival and departure the Companies must furnish to the Chief of Aerodrome all information judged necessary to control the subsidies.

The Companies must supply at the request of the Administration of Civil Aeronautics complete and detailed information as to their expenses and receipts as well as their balance sheets.

FULL SCALE DETERMINATION OF THE LIFT AND DRAG OF A SEAPLANE

By MAX M. MUNK

Technical Note National Advisory Committee for Aeronautics

Summary

The speed, barometric pressure, and number of revolutions of the engine of a seaplane were measured, including tests with stopped engine. The mean data obtained are given in the following note; the results of the gliding tests are used for the computation of the lift and drag coefficients, and by making use of them the results of the engine flights are used for the computation of the propeller efficiency.

The free flight tests described in this note were made by the author and Dr. Erich Hueckel at the testing station at Warnemuende during the summer of 1918, and are here published for the first time. It was intended to develop a simple method for the examination of the aerodynamical properties of a seaplane independent of the characteristics of its propeller. The instruments had to be simple and self-recording, and no long preparation of the aeroplane for the test could be allowed. On the contrary, the instruments had to be mounted in the aeroplane only a short time before the beginning of the test. The method was used with one aeroplane only, and the opportunity was taken to determine its lift and drag cofficients and the propeller efficiency.

The seaplane used for these tests was a German Brandenburg sea-biplane with the following characteristics:

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Spans 36'-9" and 34'-5½"
Entire wing area, S, 380 sq. ft.
Entire weight, W, 3,200 lbs.
Two floats, two pairs of struts.
Propeller diameter, D, 9' 2¼"

The instruments used for the tests were a chronograph and an ordinary barograph. The first instrument was similar to a Morse telegraph receiver; a paper strip about 1¼" broad moved with a velocity of about 7" per minute under four needles, which when under the influence of four independent electromagnets, marked the paper without stopping its course. The needles were controlled respectively by an ordinary clock-work, by the flexible shaft of the revolution counter of the engine, by an anemometer of the Robinson type and by hand. The clock gave electrical contacts at intervals of 12 seconds, the shaft leading to the revolution counter always after 2 revolutions of the shaft, corresponding to 52 revolutions of the engine. The anemometer gave contact after each 180 feet of travel of the aeroplane approximately. The fourth needle was operated mannually by the observer when the altimeter had reached certain points. It was intended to operate the fourth needle automatically too at later tests, making it indicate the density of air. Readings were also made of a thermometer, but the greatest part of these could not be used, for it appeared subsequently that the thermometer was too near to the exhaust. The density therefore had to be calculated. This was done by means of the formula $\rho = \frac{1}{8}\,.9^h$ kg sec^2 m$_4$ where he denotes the altitude in kilometers as indicated by the altimeter.

Gliding Tests.—The pilot controlled the aeroplane so that the dynamic pressure as indicated by the pilot tube was nearly constant. The velocity decreases then during the dive and the negative acceleration of the aeroplane is to be taken into account in the computation of the final results. The path is slightly curved too, but the centrifugal force is neglected in this paper. Let w denote the vertical velocity and v the total velocity, and let the angle ϵ be defined by the relation $\sin \epsilon = w/V$. The slope of the path then is taken into consideration if the usual formula for the power is replaced by the following formula

$$\frac{C_D}{C_L^{3/2}} = -\frac{w}{\cos^{3/2}\epsilon}\sqrt{\frac{S}{W}\,\frac{\rho}{2}}$$

which for small angle ϵ assumes its ordinary form.

C_L is calculated from the formula $W = C_L\, q\, S$ and, on substitution in the preceding formula, C_D is deduced.

All instruments were carefully gauged before each test; the weight of the aeroplane was deduced for each test by taking account the weights of the pilots and the estimated consumption of fuel. The table at the end of the note gives the mean values obtained from each series of tests.

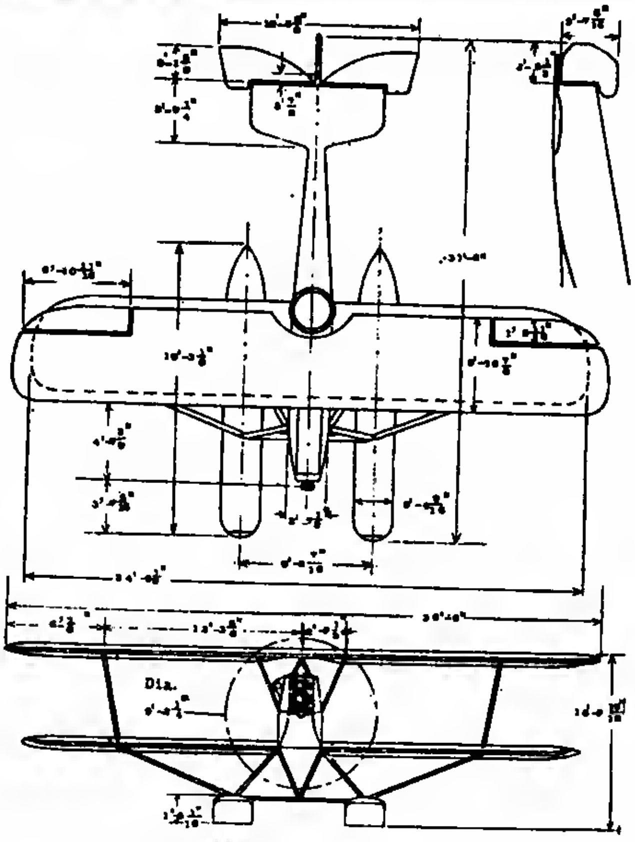
Tests With Running Engine.—The horsepower of the engine was assumed to be

$$N = \frac{n}{n_o}\,\frac{\rho - .015}{.125 - .015}\,N_O$$

where N_O is the power delivered at the normal number of revolutions n_O and at the density of the air 0.125 kg sec^2/m^4, and ρ is the density of the air in the same units.

The mean results are contained in the table. The efficiency of the propeller was deduced by making use of the drag coefficients obtained by the gliding tests; the drag of the propeller for the stationary aeroplane determined by a model test, being subtracted.

The efficiency thus obtained includes the loss involved by the mutual influence of propeller and aeroplane, consisting of an increase of the drag, which in general is not wholly neutralized



Brandenburg Seaplane.

by the increase of the propeller thrust. That is, the efficiency is

$$\frac{C_D\, S\, q\, V + u\, W}{\text{Brake horsepower}}$$

where u denotes the vertical component of the velocity. This absolute efficiency is different in general from the original efficiency of the isolated propeller.

No.	Gliding Tests						Engine Running			
	1	2	3	4	5	6	7	8	9	10
Velocity, mi/hr.	73	80	101	66	72	69	69	83	72	67
Vertical velocity, ft./sec.	-16.1	-21.8	-35.6	-13.4	-16.0	-15.6	2.2	0	-4.3	2.5
Dynamical Pressure, lbs./sq. ft.	12.1	15.2	24.2	9.5	12.3	11.8	10.6	15.0	11.5	9.8
CL	.67	.51	.32	.81	.65	.68	.79	.51	.68	.90
CD	.10	.10	.09	.11	.10	.11	.095	.082	.090	.10
CD propeller drag subtracted	.085	.085	.075	.095	.085	.095				
Propeller efficiency, per cent.							63	71	68	55
V/nD							.48	.54	.48	.45

MANOMETER FOR RECORDING AIR SPEED

By C. WIESELBERGER*

PRESSURE gages are largely used for measuring the speed of an areoplane with reference to the air (actual speed), in which connection the pressure difference is measured with the aid of a manometer. This pressure difference in some forms of the instrument (for instance, Prandtl's pressure gage) gives the pressure directly, but in other forms is proportional to it. If it is desired to record the pressure difference given by the gage, the manometer must answer the following conditions:

1. It must respond quickly so that all speed variations will be correctly recorded.

2. It must not be affected by rectilinear or curvilinear accelerations. Hence, movable parts must be counterbalanced.

On account of the smallness of the pressure to be measured (the dynamic pressure being q = 156 kg/m^2 = 1/64 atmosphere, with air density $\rho = \frac{1}{8}$), the friction of the movable parts of the instrument must be eliminated as much as possible. Since the dynamic pressure is obtained as the difference between the total pressure and the static pressure, there are two pressures to be measured. In the present instance, this is done by conducting the total pressure under a box made of very flexible membranes (Fig. 1) while the static pressure is made to work on the cover of the box by inclosing the whole in-

* Taken from "Zeitschrift für Flugtechnik und Motorluftschiffahrt."

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strument in an airtight case, in which the static pressure rules. In this way, only the difference of the pressures affects the cover of the box. The pressure exerted on the cover is received by a spring. The box is so thin that no appreciable elastic reactions are produced, provided the forces act for only short distances. Hence the distance transversed from the cover of the box is proportional to the dynamic pressure. This distance is enlarged by the lever shown in the diagram and recorded on a drum. If only a short distance is left to the box and this distance is correspondingly magnified by a light lever, a short oscillation period is obtained and a correspondingly rapid response of the instrument.

In order that no acceleration may affect the instrument readings, the following counter-balancing must be done. It is first essential to render rectilinear accelerations non-effective in both the horizontal and vertical directions. This is accomplished by means of the counterweights P_1 and P_2, which, in the acceleration of the instrument on account of its influence of inertia on the lever h_2, exert a moment offsetting the moment produced by the lever h_1, so that the pointer is not deflected. As regards the curvilinear accelerations, it is most important to offset those whose rotation axis is at right angles to the recording surface. These accelerations are rendered harmless by making the moments of inertia Θ_1 and Θ_2, of the levers h_1 and h_2, bear the same ratio as the lever arms a and b, hence $\Theta_1 : \Theta_2 = a : b$. The mass of the box cover, with half the mass of the box and the spring, is thereby to be included in Θ_1. A curvilinear acceleration then generates in the connecting rod s a momentum coming from the lever h_1, which is of like magnitude but opposite in direction to the corresponding force from the lever h_2, so they mutually offset each other. In order that the inertia moments may satisfy the prescribed ratio, there are placed on the lever h_2 two like weights G equally distant from the pivot d_2. By varying the distance of these weights from d_2, the moment of inertia of this lever can be temporarily adjusted. Curvilinear accelerations about the other horizontal axis and about the vertical axis likewise generally produce moments on the lever axes. In order to eliminate the effect of these moments, the lateral positions of the counterweights P_1 and P_2, on the axis of h_2, must be so chosen that the moments arising on the lever h_1 will offset those on the lever h_2.

When employing the manometer on rapid climbing aircraft, still another precautionary measure must be taken, in order to avoid the variometer effect of the instrument, which is caused by the volume of the case being considerably greater than the volume of the box. If the instrument is placed, for example, where the external pressure is higher, a certain interval of time will elapse, on account of the compressibility of the air, before the higher pressure has reached a state of equilibrium in the case, while this takes place more quickly in the box, on account of its smaller volume. The result is a deflection of the manometer. In order to prevent this, the air is likewise admitted slowly into the box, which may be accomplished by placing a suitable valve in the air inlet pipe. The amount of the throttling depends on the resistance of the air inlet pipes to the instrument. Of course it also has the effect of damping the instrument, but not enough to affect its responsiveness very much.

The instrument was made in the workshop of the Göttingen aerodynamic laboratory. The box is made up of ring-shaped corrugated membranes of sheet brass 1/20 mm. thick, soldered to brass rings. The pivots of both levers consist of knife edges, in order to keep the friction as small as possible. They are held

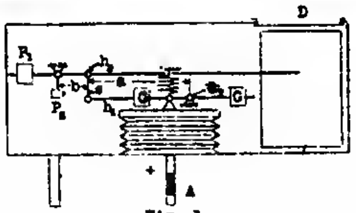

Fig. 1.

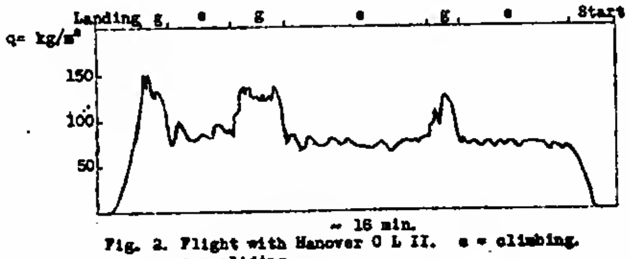

Fig. 2. Flight with Hanover C L II. s = climbing. g = gliding.

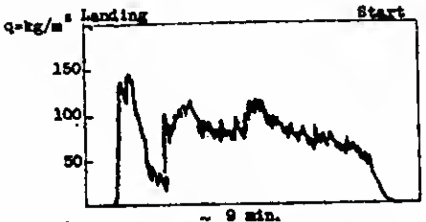

Fig. 3. Flight with Halberstadt C L IV in very squally weather.

lightly against their supports by spiral springs. All the other joints consist of leaf springs. The measuring spring is removable, so that the measuring scale may be changed when necessary. The stylus is made very light of thin sheet aluminum. The record is made on smoked paper. The drum can be introduced or removed after removing the cover D. The clockwork which drives the drum can be started or stopped by turning a small eccentric button on the bottom. The valve for preventing the variometer effect is located at A.

The instrument gave a good account of itself in the trial flights made at the end of 1919 under the supervision of Professor Proell of the Hanover Car Works. Figures 2 and 3 reproduce two of the records, on which all the details of the pressure variations can be readily recognized. That the counterweights actually produced the desired effect is demonstrated by the fact that the record shows no trace of the engine vibrations, while the record of another manometer, not counterbalanced, was spread out by these vibrations in the form of a band. In squally weather, no utilizable record could be obtained with the latter instrument. The drum, driven slowly by the clockwork, was occasionally rotated slightly in the opposite direction by the very strong vibrations. This effect found expression in a peculiar wave form in the vertical lines (Figure 3).

Translated by National Advisory Committee for Aeronautics.

French Aeronautics

It is reported that the prize of one million francs offered for the best aero engine will probably be augmented by another million, offered by the French Air Minister, for engines of 350 to 450 h.p., and weighing not more than 2 lbs./h.p. It is understood that competing engines will have to pass a reliability run of 240 hours, in stretches of eight hours each, and that the total time taken in completing the 240 hours must not exceed 100 days. The competition will start on March 1, 1924, and entries must be received before December 1, 1923.

Announcement has been made that the Aviation Committee of the Colonial Exchequer have definitely decided to organize a contest for seaplanes from April 17 to 19, under three classes: under 150 h.p.; 150 to 400 h.p.; and over 400 h.p. Eliminatory trials are to take place on April 17, when entered aircraft must ascend to 1,000 metres, and have on board, in addition to the normal useful load, sufficient fuel for 1½ hours flight. The course, Marseille-Monaco, is 413 kilometers. Prizes to the extent of over 40,000 francs are offered.

Belgian Competition

The Aero Club of Belgium has organized an International Competition for touring airplanes to be held at Brussels on June 23-25, 1922. The competition is open to touring machines, single-seaters or multi-seaters, whose engine capacity does not exceed 7 litres. The awards will be made for a total of 100 points, allotter as follows: 30 points for minimum space occupied in hangar; 30 points for general economy of the engine; 25 points for slow landing, and 15 points for quick get-off. The prizes are as follows: The King of Belgium's Challenge Cup, to be retained by the winner for one year; and the following cash prizes: 1st prize, 15,000 francs; 2nd prize, 7,000 francs; and third prize, 3,000 francs.

Argentine Aerial Club Opens

Consul General W. Henry Robertson, Buenos Aires, states that on January 6, 1922, the new flying ground and school acquired by the Argentine Aerial Club at San Isidor, alongside the grounds of the River Platte Aviation Co., were opened for use, more then 20 machines taking part in the ceremony.

Opportunity in Colombia

According to Mr. Edmund B. Montgomery, American Vice Consul at Barranquilla, Colombia offers an opportunity for the establishment of an air transport service. The facilities and carrying capacity of such a service, however, must be greater than that rendered by the present company (Colombian-German Aerial Transport Co.), which maintains a hydroplane service, and which, for the months of October, 1921, to January, 1922, inclusive, reported 307 flights, aggregating 57,640 kilometers, 303 passengers carried, and 29,280 kilograms of freight transported. This company has a contract to carry mail for a period of five years, the Government subsidizing it to the extent of $100 per trip.

As the river steamship transportation is uncertain in the dry season, which is now coming on, an air service with machines carrying 10 to 14 passengers would undoubtedly get all the passengers and freight that could be carried, although one drawback to large air boats on the river is the danger of contact with driftwood in starting and landing. The ratification of the American-Colombian treaty should be a help in any negotiations which may have for an end the establishment of such a hydroplane service on the Magdalena River by American interests in co-operation with Colombians.

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COMMERCIAL AVIATION DEVELOPMENTS IN EUROPE

By W. KNIGHT, M. E.

(Continued from page 109)

RUMANIA

Commercial aviation in Rumania has actually started its activities in 1921. In fact, it was only last October that the first aeroplane of the "Franco-Romane Aerial Transport Company" made its first flight from Paris to Bukarest.

The line Bukarest-Paris-Constantinople is going to be operated regularly this year. The trip from Paris to Bukarest will be made by starting from Paris at 6 P. M. and arriving at Bukarest two days after, early in the morning. For the year 1922, the "Franco-Romane Aerial Transport Company" will have an aeroplane provided with sleeping quarters for 20 passengers which shall be used on the line between Paris and Bukarest. This company is already operating the lines between Paris and Praga and between Paris and Warsaw.

Tbe capital of the company is 10,000,000 of francs. This company, we might say, is an enterprise mostly financed and supported by French capital. In fact, the French Government gives 9 millions of francs per year as a subsidy to this company and the President of this company itself, is General Duval, former Chief of the Air Service in France.

The Polish Government also gives to this company 1,000,000 francs per year subsidy, payable in oil and fuel and, besides this, grants to the "Franco-Romane Aerial Transportation Company" the exclusive operation over the Polish territory for ten years.

The Czecho-Slovak Government also pays a subsidy of 5 million crowns per year, and grants to the company the exclusive right of operation for ten years. The Turkish Government grants to this company the monopoly for the transportation of the mail between Bukarest and Constantinople for five years, subject to renewal. The Rumanian Government, besides paying a subsidy to the company, grants it the exclusive right of operation on the line Paris-Strasbourg-Praga-Vienna-Bukarest-Constantinople.

The following project for the development of civil aviation in Rumania has been submitted by Mr. Mirea, Director of the Air Service under the ministry of transports in Rumania. The project starts with considering the following nine international lines passing through Bukarest.

1. London-Paris-Vienna-Budapest-Bukarest.
2. Trieste-Belgrad-Bukarest.
3. Athens-Salonica-Sofia-Bukarest.
4. Constantinople-Adrianople-Bukarest.
5. Constantinople-Costanza-Bukarest.
6. Hamburg-Berlin-Praga-Vienna-Budapest-Bukarest.
7. Dantzig-Warsaw-Leopoli-Bukarest.
8. Bukarest-Chisinau-Kiev.
9. Bukarest-Odessa.

In conjunction with these nine international lines, the following lines shall be operated:

1. Bukarest, Craiova, Trunu, Severin, (effecting the liaison with Belgrad); Temesvar (liaison with Seghedin, Budapest); Avad, Orodia (liasion with Delretin, Budapest).
2. Bukarest, Giurgin (effecting liaison with Sofia, Athens, Adrianople, Constantinople).
3. Bukarest, Tecuci, Iassy (liaison with Warsaw).
4. Bukarest, Costanza (liaison with Odessa and Constantinople).
5. Bukarest, Braila, Galatz, Chisinau (liaison with Ukrainia).

Besides these lines, connecting together the various international lines, the following lines for the local traffic shall be operated:

Bukarest-Brasov, Bukarest-Pitesti-Sibiu-Cluj-Orodia, Galat-Tecuci-Brasov-Sibiu.

Airdromes for these lines shall be provided at Bukarest, Craiova, Temesvan, Orodia, Costanza, Iassy, Vernovitz, Balatz, Chisinau, Turnu. Severin, Arad, Giurgin, Tecuci, Braila, Brasov, Pitesti, Sibiu, Cluj.

This project comprises also the establishment of an aircraft manufacturing plant capable of an output of 300 aircrafts per year. The capitalization of the company undertaking the development of this plan has been anticipated to be 260 millions of lires and the total cost of operation per year has been figured to be 144 millions of lires. The realization of this project will be effected mostly with foreign capital. French and British capital seem to be very much interested in its development and every facility will be granted by the Rumanian Government for the realization of this undertaking.

OTHER COUNTRIES

Besides France, England, Belgium, Italy, Germany and Rumania that we have considered so far, minor attempts for establishing civil aviation are more or less apparent in the rest of Europe. In some countries like Switzerland, we find that civil aviation activities are intimately connected with the tourists traffic and when we consider the beauty of the panorama of the Alps which can be obtained by flying over the mountains, we might expect quite a lively development of civil aviation there, however limited to excursions over the Alps and the lakes of Switzerland.

At the present time, the "Ad-Astra" of Zurich, is doing most of the commercial flying carrying passengers for excursions and also for taking photographs of the Alps from the air, which are sold to tourists at a good price.

A number of aerodromes and hangars have been constructed at Dudendorf, Geneve, Cointrin, Lausanne Blucherette, by the department of civil and military aeronautics. At Dudendorf especially, they have a fine aerodrome with twenty hangars and all modern facilities for testing motors and propellers.

Hangars and aero-ports for hydroplanes are to be found at present at Geneve, Lausanne-Ouchy, Locamo, Lugano, Lucerne, Korschack, Romanschorn and Zurich.

Landing fields for aeroplanes are now open at Avenches, Bellinzona, Zurich-Spreintenbach, Aaran, Berne, Biere, Colombier, Frauenfeld, Thun and about two dozen of private landing fields are scattered all over the country.

Due to the geographical position of Switzerland and the Alps, which in some places reach in height to nearly 14,000 feet, international lines operated with commercial aeroplanes which are not designed for flying at very great altitudes shall find a barrier in Switzerland and shall have to avoid the route over Switzerland, in spite of the fact that it would make a short flight to fly directly over the Alps rather than circling around them over the routes, Paris-Venice, London-Milan, Munich-Bordeaux, Vienna-Lyons, etc.

There is now a project in Switzerland of forming a local company equipped with aeroplanes designed for carrying passengers with a sufficient degree of comfort over great altitudes, manned by pilots, well familiar with the exceptional atmospheric conditions prevailing over the Alps. This company would operate in connection with the international lines crossing over Switzerland and would take care of the transportation of the passengers from one side to the other of the Alps. In other words, this company would operate aeroplanes like shuttles over the Swiss border.

In Sweden, some attempts have been made by the Svanska Luftrafik, A.B., last year for establishing an air mail service. The operation of this company, so far, is in an experimental stage. In the three months of July, August and September of last year, this company has operated the line, Stockholm-Reval, and 800 kilograms of mail matter have been transported. The distance between Stockholm and Reval is only 280 miles, which were covered on an average of between 2½ and 3 hours. Only 21 passengers have been transported and 92% of the scheduled trips were completed in the above named period of time.

In Spain, besides the French line operating between Perpignan and Casablanca there is the Madrid-Alicante line operated by a private concern and the Melilla-Algesiras operated by the Government. A project for a dirigible line between Spain and South America is now being considered.

In Norway, in the Netherlands and in Czecho-Slovakia some noticeable signs of real activities are to be found.

In August, 1919, "The International Aircraft Association, Ltd." (I.A.T.A.) was formed for the purpose of insuring a uniform exploitation of international lines, so as to avoid competition by agreeing on standard rates and technical requirements of aircraft used by the Aerial Navigation Companies in the membership of the I.A.T.A. At the present time, the following companies have joined the I.A.T.A., Danske Luftfartselskab, Denmark; Danziger Luftreederei, Free State of Dantzig; Deutsche Luftreederei, Germany; Finska Luftrafik; Finland; Koninklijke Luchtvaart Maatschappij, Holland; Svenska Luftrafik, Sweden.

Conclusions

From the summary review that we have made of the status of civil aviation in Europe at the end of 1921, we might draw

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a few conclusions which might be useful to us in establishing and operating aerial lines in this country.

The outstanding feature of Aerial Transport Companies in Europe, has been, first, the great interest shown by European Governments in providing these companies with sufficient subsidies to allow them to survive the first few years when they will have to operate at a loss, and also in providing a good organization of the aerological and wireless services, landing fields and signals for night flying, which facilitate the operation of the aerial lines and insures to a great extent, the safe operation of aerial routes.

Second, almost every aerial transportation company operating at present in Europe, is using aircraft not well adapted to the commercial exploitation which is required of them. Third, the cost of operation of these lines is greatly increased due to insufficient volume of commercial load and passengers carried over the lines flown. The cost of a ton per mile is too high as yet to successfully compete with other existing means of transportation. This being especially true over short lines where the saving of time effected is hardly in proportion with the increased cost of transportation.

The high cost of operation is due mainly to the overhead expenses which are entirely and unavoidably high as compared to the volume of business handled and is also due to the type of aircraft used.

The present limit of from 100 to 200 flying hours before overhauling aerial engines is ridiculous. Motor car engines have run 80,000 miles or perhaps 3,000 hours before overhauling, (and air engines run in far better conditions than any of the motor car engines).

The life of the most of the present commercial aircraft as used in Europe, is entirely too short and the depreciation of these aircraft over a rather short period of time must necessarily increase the cost of operation.

Insurance rates are at present too heavy a burden for the exploitation of aerial lines but this again is due mainly to the types of aircraft used and is due to the unperfected ground organization. A real sound ground organization will avoid accidents and will save labor expenses to the extent of something like 30% on the cost of that item in a carelessly administered business.

The present tendency in Europe is to effect both a vertical and horizontal combination of aircraft operating companies and aircraft manufacturers. This is of course, a sound policy which will prevent competition in rates and will act as a spur to each company for supplying better services and thus securing more business.

In Europe, laws and regulations affecting aerial navigation are being developed for both international and national operation of aerial lines. A good deal is yet to be done along these lines and the future of civil aviation developments along national and international lines depends on sound laws and regulations providing a fair guarantee of safety for the passengers, without imposing unnecessary restrictions to the operating companies which would hinder the commercial exploitation of aerial lines.

(*Continued from page* 135)

ful and the air perfectly smooth. By this time the sky to the froot had become entirely clear, the rest of the journey being made under the characteristic weather conditions of Texas, and without event. Ellington Field was reached at 10:15, and the Chief of Air Service immediately started an inspection which carried him up to some time after four o'clock. During this time he met all the officers of the field and gave them a short talk with reference to plans for Air Service troops in the 8th Corps Area. The talk was followed by a luncheon, after which an aerial review took place. Machines took off in formation in spite of the cross winds and bumpy air. Lieut. Johnson demonstrated great skill in flying in his demonstration of the Thomas-Morse pursuit plane. Aerial gunnery and bombing added much interest to the flying.

Prior to his departure for Washington that night, the General attended a dinner in his honor given by the Houston Chamber of Commerce at the Rice Hotel.

The Hawaiian Divisional Air Service

The 4th Squadron (Observation), Capt. H. H. Young, commanding, which has been stationed at Luke Field since January 24, 1920, has been relieved from duty with the 5th Group and ordered to proceed to Schofield Barracks to become the nucleus of the Hawaiian Divisional Air Service. Henceforth the function of the squadron will be solely observation in conjunction with problems affecting the Hawaiian Division. Accompanying the 4th Squadron to duty with the Hawaiian Division are the 11th Photo Section and Branch Intelligence Office No. 11.

Major George E. Stratemeyer, Air Service, has been assigned as Divisional Air Officer, Hawaiian Division. The flying field selected has been used as a cavalry drill ground, is well located near the railroad and road, has sufficient space for the erection of buildings, hangars, etc., and is large enough for any type of airplane. Canvas hangars are being erected, and the field is being cleared of weeds and underbrush, which has grown up in spots. The enlisted personnel are being quartered in the 35th Infantry Barracks, and the officers are assigned quarters in the 21st, 27th and 35th Infantry areas. A study of the field is being made, and estimates of funds for necessary construction work are being prepared.

XBIA Planes on Cross Conntry Trips

During the week ending March 18th, the 13th Squadron at Kelly Field made seven cross country trips (13 flights), using five XBIA's and two DH's. These mark the first cross country trips ever attempted with the XB's, the ban on cross country on this type of plane, being only recently lifted. One plane was forced down, due to a broken oil lead, but same was repaired and the planes returned to Kelly Field without further mishap. The 13th Squadron pronounces them an ideal type of ship for cross country flying, if the vibration of the motor can be overcome. The gas consumption is very low.

Flying Time at Carlstrom Field

The records from the flying office at Carlstrom Field, Arcadia, Fla., show that the flying time for February totalled 1,563 flying hours. Some 93 student officers and cadets are at present undergoing flying instruction. These students are equally divided between two stages, and a force of fifteen dual instructors are instructing from the two stages. The present class of students will probably be the last one to learn to fly in Florida, due to the expected moving of the Primary Flying School.

Advanced Training of Flying Cadets

The advanced training of flying cadets at Mather Field is going along with particular success in smooth formation flying. Flights of eleven and twenty-three ships each have been practiced for the past ten days, with an officer as flight commander, the cadets piloting the other ships. These formations were part of the attraction at the Aerial Circus held at Mather Field on March 19th for the benefit of the Army Relief Society and the improvement of that field.

Status of 326th Observation Squadron

Excellent progress has been made in the organization of the 326th Observation Squadron, of the 101st Division, which is now 75 per cent. complete in its organization. The headquarters of the squadron is at Durand, Wisconsin; the headquarters of the 1st Flight Section is at Madison and the headquarters of the 2nd Flight Section at Milwaukee. The Squadron Commander, Captain Horace P. Orlady, will soon have completed his permanent assignment of personnel, and hope is entertained that there will be some training this year for such officers as are available. The officers of the squadron are kept informed of its progress.

Joint Training of Coast Artillery and Air Service

The War Department is taking action to insure coordination of the Coast Artillery and the Air Service in coast defense, under the basic principles of warfare and training recently laid down. The chiefs of the two combatant arms concerned have been instructed to consider together the question of joint training, with a view to carrying out experiments in joint training and tests of materal during the coming summer.

The war with Germany furnished such an exhaustive test of the powers of mobile troops that the doctrines of training for such troops were firmly established. Coast defense, however, was not so extensively tested, and many questions of the best methods and material to be used were not solved in battle. Since the war various experiments, such as the bombing of warships, have indicated the increasing power of aircraft in coast defense. It is with a view to developing the potentialities of this new arm, as well as to insure properly coordinated training, that the War Department is taking action.

Both branches undoubtedly have an important role in coast defense, and tests will be for the purpose of obtaining coordination in their training. It is expected these tests will include:

(a) Anti-aircraft target practice against air targets to determine the vertical range at which bombing planes could operate without being subjected to effective fire.

(b) Bombing practice against coast defense installations to determine the effect of aircraft bombs on such a target.

(c) Combined target practice at extreme coast artillery ranges to determine the relative efficiency of bombing planes and large caliber coast artillery guns in operation against an enemy fleet.

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NAVAL and MILITARY AERONAUTICS

General Patrick on Inspection Tour

It is doubtful if any chief of a War Department Bureau or other official even on a "hurried" trip, equalled the record time in which Major General Mason M. Patrick, Chief of Air Service, accomplished an inspection tour of Air Service stations in the Southwest. When it is considered that inside of five days the Chief of Air Service inspected Kelly Field, Brooks Field, Love Field, the Helium plant at Fort Worth, Post Field and Ellington Field, one may well wonder how it was done, especially in view of the fact that at three of the stations above mentioned he spent practically the entire day going through the buildings, examining the property and inspecting the personnel.

The answer is that, outside of the journey from Washington to San Antonio, and the return journey to Washington from Ellington Field, the General utilized the quickest and most comfortable method of transportation—a DH4B airplane. Major H. A. Dargue, on duty in the Office of the Chief of Air Service, Washington, piloted the General's plane, and Lieutenants Duke and Dunton from Kelly Field in another plane acted as an escort, the two machines being company for each other in the air. When stops were made, Lieuts. Duke and Dunton rendered service in attending to the details of securing gas and oil and making careful inspections of both machines.

The weather man was in a very surly mood during several days for this record inspection trip. His ill humor, however, availed him but little, for despite lightning, rain storms, low dark clouds and Oklahoma cyclones, the trip was completed with only a slight delay. The flying was greatly enjoyed by the General, and it is the longest trip by air he has thus far made—somewhere around 900 miles. The experience gained by him on account of the varied weather conditions, especially the flight from Post Field to Love Field, will undoubtedly be of great assistance to him in dealing with matters in which flying is involved.

Proceeding from Washington on March 6th, General Patrick arrived at San Antonio, Texas, early in the morning of the 9th. He made a thorough inspection of all Air Service establishments—Kelly Field Nos. 1 and 2, the Air Service Depot, and Brooks Field. Late in the afternoon of the 9th, after the inspection of Kelly Field No. 2, a delightful reception was tendered him, in which an opportunity was given all the officers and their families to be present. Dancing, with music by the Kelly Field orchestra, was very much enjoyed, and refreshments were served. In the evening the St. Anthony Hotel was the scene of a banquet tendered the General by the field officers of the Air Service at San Antonio. There were also present at this dinner General Hines, the Corps Area Commander; General Lewis, Commanding Officer of the Second Division, and a classmate of General Patrick; General Williams, the Chief of Ordnance, who had just arrived on an inspection trip; and several staff officers of the Corps Area Commander. General Patrick took the occasion to inform the field officers during the course of the dinner of his plans to concentrate the Air Service as much as possible in the vicinity of Kelly Field. The Corps Area Commander made a few very complimentary remarks about the Air Service troops under his jurisdiction.

On the morning of the 10th, an aerial review was held, in which there was considerable formation flying and acrobatics. The GAX machine attracted a great amount of attention, due not only to the tremendous amount of noise it made, but to the expert flying performed by its pilot. On one occasion this "mighty air tank" came within inches of the ground at a tremendous speed and maintained this altitude while passing in review. The impression gained by the Chief of Air Service through the flying of the GAX was that its offensive power rested more in the roar of its motors than the roar of its canon.

The review at Kelly Field No. 2 was followed by an inspection of the Depot at Kelly Field No. 1. Following a luncheon at the Depot, the Chief of Air Service proceeded by airplane to Brooks Field and made a thorough inspection of that place, including the large airship hangar now nearing completion. Upon finishing his inspection at Brooks Field, he inspected the whole layout of Brooks Field, Kelly Field and the Depot from the air, and then proceeded to Camp Stanley to look over the bombing and gunnery ranges used by the groups stationed at Kelly Field. Observing the bombing and gunnery ranges from the air gave the Chief of Air Service a much better idea of them, it is thought, than he would have gained on the ground, as he saw the character of the surrounding country and the distance these places are from Kelly Field. He expressed the opinion that these ranges should be nearer to Kelly Field.

Early the next morning the Chief of Air Service was "on his toes" for the flight to Dallas, Texas. The day was a beautiful one, and it did not take long to roll off the many miles between the two places. The trip was made by way of Austin and Waco, and the 275 miles was covered in 2¼ hours—slightly over 2 miles a minute. During this trip the General was greatly interested in the character of the country and the air conditions, although he found he had plenty of time to read the San Antonio morning papers. At Love Field an inspection was made of the buildings and the large amount of surplus property. In the afternoon a trip was made to Fort Worth, where a thorough and very interesting inspection of the Helium plant was accomplished.

The trip from Love Field to Post Field —185 miles—was covered in a comparatively short time. The Chief of Air Service was shown Barron and Taliaferro Fields at Fort Worth (now abandoned). He saw the Helium plant from the air, and then looked over Call Field near Wichita Falls, also the great oil fields north-west of Wichita Falls, including the Burk Burnett Field. After passing into Oklahoma there was little of interest until Post Field was reached. As this was Sunday, and the visit of the Chief of Air Service was entirely impromptu, there were no formal preparations made for his inspection. He went through most of the principal buildings at the field, however, and had a very pleasant visit with the officers. In the evening a very enjoyable dinner party was held in the Commanding Officer's quarters. Weather conditions appeared to indicate that the next day would be as fine as the preceding ones for a continuation of the travel by air.

In order to obtain a good start on Monday morning for the flight from Post Field to Ellington Field, everybody arose early, only to find low clouds, high winds and rain storms. Two machines went out a little before eight o'clock to determine the feasibility of making a start, but a ceiling of only 500 feet could be attained, and so it was decided not to attempt to get away until more favorable conditions existed. By 2:30 in the afternoon the rain storms had become less frequent and the clouds had lifted, due to the strong wind, so that a ceiling of 3,000 feet was obtained. Accordingly, the start for Dallas was made, but upon progressing southward it was found necessary to keep on a line toward Forth Worth, as a very heavy bank of dark clouds lay to the eastward, pouring rain on the country and causing many places to be visited with thunder-storms and, as was learned later, with tornadoes. There seemed to be a path, however, practically cleared all the way to Fort Worth, and so the flight that far was uneventful, except for going through two small rain storms and watching the maneuvers of the heavy clouds on the left. At Fort Worth it became necessary to turn eastward and plow into this wall of dark clouds. The pilots of the two planes zigzagged around somewhat to find the most desirable place to go through, but when about midway between Dallas and Fort Worth a downpour of rain was encountered, accompanied by thunder and lightning. It was not long, however, before the airmen passed through this and were out of the rain, although forced fairly low by the heavy clouds. A landing was made at Love Field and, before the machines could be taxied into the hangar, the downpour of rain just passed through struck the field. It was too late at this time and the weather conditions too adverse to attempt to proceed to Ellington Field, and so a stop overnight was made in Dallas and plans formulated for an early start the next morning.

The weather on Tuesday morning appeared to be little better than the night before, but careful study indicated that the clouds were clearing towards the south and that better weather conditions would obtain the further south the pilots progressed, and so a start was made from Love Field at exactly eight o'clock. It was raining at the time, and the airmen did not get clear of the rain until some distance south of Dallas. A good ceiling was obtained, however, and for approximately the first hundred miles, flying at an altitude of 3,000 feet, the trip went very smoothly. Then the sun began to break up the clouds and the air became very rough. The planes ascended to a little over 5,000 feet, at which altitude the weather was delight-

(Continued on page 134)

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FOREIGN NEWS

French Air Mail Stamps

In the French Morocco colony a beautifully engraved set of three aeroplane stamps has recently been issued. The design represents an aeroplane over the town of Casablanca. The values are 75 centimes, 1 and 2 francs.

Gothenburg Aero Exhibition

The Aeronautical Chamber of Commerce has received the program for the International Aero Exhibition in Gothenburg. Details are as follows:—

"The City of Gothenburg, the foremost Swedish port with regard to navigation and export, will celebrate the 300th anniversary of its foundation, by a Jubilee Exhibition, to be held from the 15th of May to the 10th of September, 1923, embraceing *inter alia* a General Swedish Export Exhibition and also an Exhibition by the Swedes abroad. In connection herewith there will be held the first Swedish International Aero Exhibition, 20th of July to 12th of August, 1923, in cooperation with the Royal Swedish Aero Club.

"The exhibition grounds are located in Gothenburg, on the field Exercisheden, the area of which amounts to 12,000 square meters, and besides a number of small buildings there will be erected a large exhibition hall, measuring 9,650 square meters.

"Aerocraft destined to the exhibition may land and start on the aerodrome of Gothenburg at Torsland where competitions will even be arranged.

Extent of Exhibits

Group A. Flying Machines.
1. Aeroplanes.
2. Seaplanes and flying-boats.
3. Sundry aeroplane equipment.

Group B. Balloons and Aeroships.
1. Aeroships.
2. Free balloons.
3. Moored balloons.
4. Sundry balloon and aero equipment.

Group C. Hydroplanes (gliders).
1. Hydroplanes.
2. Sundry hydroplane equipment.

Group D. Motors and Propellers.
1. Motors for aerocraft.
2. Propellers.
3. Sundry accessories.

Group E. Manufacture, etc.
1. Equipment for experiments.
2. Machinery for aerocraft factories.
3. Devices for tests and control.

Group F. General Equipment for Aerocraft.
1. Instruments for navigation and maneuvers.
2. Lighting and signalling.
3. Telegraph and telephone.
4. Photography (see group 1, 4.)
5. Parachutes.
6. Outfitting.
7. Sundries.

Group G. Material and Partly Finished Products.
1. Wood.
2. Metal.
3. Covering.
4. Pigments, dopes and varnishes.
5. Fuels and lubricating materials.
6. Sundry materials.

Group H. Aerodromes.
1. Hangars and equipment for hangars.
2. Mooring arrangements, slip-ways, pontoon docks, etc.
3. Lighting and signalling.
4. Hydrogene works.
5. Equipment for meteorological service.
6. Sundries.

Group I. Science, Literature, Instructions, Inventions, etc.
1. Aerodynamics.
2. Aerostatics.
3. Aerology.
4. Photography.
5. Laboratory equipment.
6. Training of pilots.
7. Commercial avaiation.
8. Military aviation.
9. Aer mails.
10. Literature.

"With a view to judging whether the available exhibition grounds will prove to be sufficient, or if an enlargement of the buildings must be accomplished, the Board of Administration may ask for information already previous to the 1st of April, 1922, as to the approximate space to be reserved.

"Definite application to be given on form specially established, and to be in the hands of the Board on January 1st, 1923, at the latest.

"Such application for exhibition space is to be sent in and received conformably to the directions given by the Board for the purpose. The application to contain a complete list of those objects, the exhibition of which is desired, and the permission of such exhibition is granted on the condition only that no alteration be made unless approved of by the Board. The Board reserve to themselves the right to consider the applications, and, if there be any reason, to exclude exhibits.

"Any allotment of space to an applicant may be revoked, unless the applicant within a fortnight prior to the opening of the exhibition produces on demand a proof of his being able to exhibit the articles named in his application.

"The Board reserve to themselves the right to retrench exhibition space already allotted, provided that the respective exhibitor be notified thereabout before the 1st of March, 1923.

"Offices of Board and Secretary:—Johanneburg, Gothenburg 5. Telephone Nos. 16390 and 16394. *Post Address:*—Hug, Gothenburg, Sweden.—Telegrams:—Ilug, Gothenburg."

Food by Aeroplane

It is reported from Holland that exceptionally severe weather would have imposed great hardships upon the inhabitants of the many islands which lie to the north of the Dutch mainland, were it not for the timely assistance rendered by the big Fokker aeroplanes of the Royal Dutch Air Service Company. All boat traffic having ceased owing to the ice, the aeroplanes were used to deliver large quantities of food and other supplies to the islands.

The recent railroad strike in Germany has also provided an excellent opportunity for the Dutch Company during the otherwise somewhat unprofitable winter season. The Fokker planes left Rotterdam for Hamburg and Bremen, there to connect with the D. L. R. line to Berlin, three times daily, loaded to capacity with mail, express and passengers.

Forced Landing of Plane on Mt. Vesuvius

A dispatch from Naples, dated March 16th, states that an aeroplane proceeding from Rome, of the firm Sarri of Rome, arrived at Naples a few days ago, carrying on board an American cinema "Reporter." The aeroplane was piloted by the well-known pilot, Angelo Menegelli, of Viterbo.

On the morning of the 16th, the reporter wanted to continue the flight in order to take a moving picture of Mt. Vesuvius at a very low altitude, and Mr. Menegelli conducted the aeroplane on the great crater. A military aeroplane was following Menegelli's plane, and while they were flying around the crater of the volcano and the operator was engaged in taking pictures of the abyss, the motor suddenly stopped. The pilot, however, skilfully glided his plane and prevented it from falling into the crater, landing on a small space near by. The passengers got out safely from the irregular landing place, but the aeroplane was rendered unserviceable, its wings and fuselage being damaged.

Italian Aeronautical Events for 1922

At a recent meeting of the National Italian Aeronautical Federation final determination was made of aeronautical events to take place this year, as follows:

Trophy of the County, City and Chamber of Commerce in Genoa—Genoa	May
Berardy Trophy for Balloons (International)—Milan	June
Piedmont Trophy—Turin	June
Baracca Trophy—Turin	June
Loreto Trophy—Loreto	August
Tyrrenean Trophy (International)—Naples	August
Schneider Trophy (International)—Naples	August
Italia Trophy (International)—Milan	September
Parachute Contest (International)—Rome	October
Free Balloon Race—Rome	October
Mapelli Trophy—City and date to be set.	

Successful Trials of the Aveline Automatic Pilot

A young Frenchman, M. Georges Aveline, has invented an automatic stabilizer which promises to go a long way in making flying practically safe. Experiments are now being conducted in France with this stabilizer by the Messageries Aeriennes Company, and a report on tests made on February 14th above Le Bourget in a Farman "Goliath" indicates that the stabilizer is capable of great services in traversing large banks of fog, and in taking off from aerodrames covered in fog. In this latest test several pilots were on board the Goliath, which flew through the fog and emerged into clear air after 1,500 meters altitude, effecting the climb without difficulty and without intervention from the pilot. At this altitude several turns were made, both left hand and right hand. The engines were then throttled down and the machine descended to within 50 meters from the ground, without the intervention of the pilot. During the descent the engines were several times opened up and throttled down, the machine automatically climbing when the engines were opened out and gliding when they were throttled down. Three times during the flight the pilots were changed, the machine flying entirely without pilot during these changes.

The above invention employs a form of the pendulum principle, and part of the device is electric, part pneumatic and part aerodynamic. The pendulum portion, which is only partly to be regarded as a pendulum, consists of an inclinometer in which the fluid is mercury. This mercury is contained in a disc with a narrow circular groove, and serves to make and break an electric contact which operates the valves that admit compressed air to the air cylinder whose pistons actuate the control cables.

A World's Speed Flight

Last autumn M. Sadi Lecointe, the famous French flier, and holder of the world's record for speed in an aeroplane, made an average of 206 miles per hour over four laps, using a Nieuport-Delage fitted with a 300 Hispano-Suiza engine. A little later Mr. J. Herbert James, holder of the British flying record for speed, flying a Gloucestershire Mars I plane, fitted with a 450 h.p. Napier engine, made an effort to beat Lecointe's record, and actually succeeded in doing 212 miles per hour over the lap, though his average for four laps was only just over 196. Since Mr. James' feat there has been much controversy as to whether his machine or the Nieuport-Delage is the fastest in the world. Lecointe's record was made flying both with and against the wind, whereas Mr. James' record on the one lap was made with the wind only. A British newspaper, the South Wales *News*, states that in order to settle this controversy Mr. James challenged M. Lecointe to a series of air races, to take place at Croydon, London, on the occasion of the Royal Aero Club's race meeting on Easter Monday next, for £500 a side, and that M. Lecointe accepted subject to a return race being arranged in France. It is said that a series of flights will be carried out in order to eliminate flukes, and an effort will be made to break the existing world's record. The only possibility of the match falling through lies in the fact that the Nieuport-Delage machine lands at a speed of over 100 miles per hour, and the Croydon airdrome may possibly be too small for a safe landing. The French airman will visit Croydon shortly to inspect the airdrome, and if he is satisfied as to its size the contest will take place.

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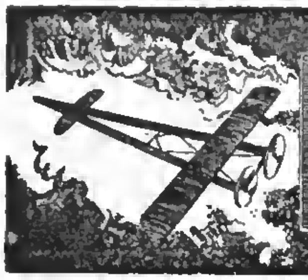
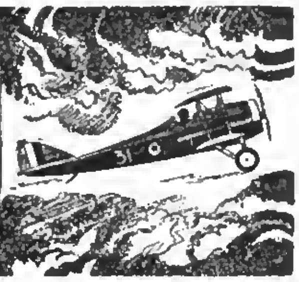


ELEMENTARY AERONAUTICS and MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nartonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS, KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Testing Aeroplane Steels for Hardness

THERE are a great variety of steels used in the making of aeroplane fittings, each selected for the particular work it is called upon to perform. In selecting the various classes of steel it is necessary to know the hardness of the metal so that it can be properly adapted to its work.

For testing the hardness of metals there are four typical methods. The sclerometer method, introduced by Turner; the scleroscope method more recently invented by Shore; the indentation test adopted by Brinell about 1900; and the drill test, introduced by Keep, a few years earlier.

The principles underlying each of the four methods are briefly as follows:

Turner's Sclerometer

In this form of test a weighted diamond point is drawn, once forward and once backwards, over the smooth surface of the metal to be tested. The hardness number is the weight (in grams) required to produce a standard scratch. The scratch selected is one which is just visible to the naked eye as a dark line on a bright reflecting surface. It is also the scratch which can just be felt with the edge of a quill when the latter is drawn over the smooth surface at right angles to a series of such scratches produced by regularly increasing weights.

Shore's Scleroscope

In this instrument, a small cylinder of steel with a hardened point, is allowed to fall upon the smooth surface of the metal to be tested and the height of the rebound of the hammer is taken as a measure of the hardness. The hammer weighs about 40 grains, the height of the rebound of hardened steel is about 100 on the scale, or about 6 1-4 inches, while the total fall is about 10 inches.

Brinell's Test

In this method, a hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation of a size such as can be conveniently measured under the microscope. The spherical area of the identation being calculated, and the pressure being known, the stress per unit of area when the ball comes to rest is calculated and the hardness number obtained. Within certain limits, the value obtained is independent of the size of the ball and of the amount of pressure.

Keep's Test

In this form of apparatus a standard steel drill is caused to make a definite number of revolutions, while it is pressed with standard force against the specimen to be tested. The hardness is automatically recorded on a diagram on which a dead soft material gives a horizontal line, while a material as hard as the drill itself gives a vertical line, intermediate hardness being represented by the corresponding angle between 0 and 90 degrees.

New Model Club at College Station, Texas

Under the leadership of Staff Sgt. Joseph S. Ott, an enthusiastic group of model flyers are conducting meetings and work classes at College Station, Texas. Permission has been obtained from the College authorities for the use of one of the work shops, where the members meet every Saturday. The entire day is given over to this work exclusively.

Before joining the U. S. Air Service, Sgt. Ott was a member of the Illinois Model Aero Club, his home being in Chicago. This accounts in a way for the progressive spirit shown by the new club which now numbers twenty members. Under his attention models of many varieties are being built and experimented with. In order to give the best samples for the boys to work from, Mr. Ott himself built 12 models as follows: 3 eighteen-inch tractors; 3 twenty-one inch tractors, 1 thirty-inch pusher (which made a flight of 1,200 feet); 2 twenty-one inch tractor seaplanes; 1 thirty-inch single pusher R. O. G. (which climbs about 100 feet and flies 900 feet); 1 twenty-four inch tractor and one scale monoplane.

Although it is two years since building his previous models, Sgt. Ott has designed and built a most interesting type of "Parachute" tractor, which will be described in a later issue of Aerial Age. This model flies about 40 to 50 feet high, and releases a miniature parachute by means of a thread connected to the propeller shaft.

The first model built for one of the school boys, resulting in the idea of forming a club, was a 21-inch R. O. G. tractor, which made two flights of well over 600 feet and nearly always can be depended on for flights of 500 feet. Since the first group of models was built, the number of "stick-type" models constructed in one month by Sgt. Ott totals twenty-one. His pupils have made five successful 18 inch tractors so far.

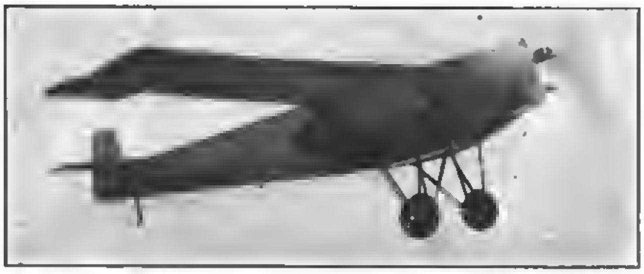
Aviators to Study Ways of Birds High in the Air

Pilots of British commercial aircraft are to be asked to cooperate in solving some of those mysteries of bird life which have so long baffled all efforts of naturalists.

Airmen of the Continental expresses will, it is hoped, throw light on such fascinating subjects as the height at which huge flocks of birds fly when migrating to other lands, and what altitude they are able to attain in flight. They will also help in elucidating the speed of our feathered friends and in unveiling secrets that have baffled poets and scientists for thousands of years.

There are fascinating problems that may now be solved by our flying men. What power is it that enables migrating birds to traverse oceans and continents in a single flight? What connection is there between the weather and migration? After all else, how is it that birds can fly in the darkness of the night without fear of danger?

These are some of the mysteries that may be solved by aerial ornithologists.



A flying scale model of the Fokker FIII monoplane by M. J. Bayhi, as described in Aerial Age last week

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RADIO DIGEST

New York Police Combine Radio and Aviation

Keeping fully abreast of the rapid evolution of radio development in these miraculous times of electrical control, the Police Department of the City of New York has in its aviation and radio division a reserve force of limitless potential value as a crime detector and arrester.

It claims to be the most efficient aerial unit in the world and, under the supervision of Rodman Wanamaker, special deputy police commissioner, in command of all reserves, has moved steadily onward from a small beginning to its present high place.

Its commanding officer is Colonel Fiorello H. La Guardia, a soldier with a fine record as an aviator on the battle fronts of the great war and later elected president of the Board of Aldermen of New York.

Its radio instruction is in the efficient hands of Captain Arthur C. Werther.

Inspector John F. Dwyer has had charge of the selection of pilots, and for four years the planes of this force have been flying about the harbor of New York, day and night, and have yet to report the first accident.

Major John F. Brennan is recruiting officer and has been instructed to recruit two more companies of cadets for the corps. His headquarters is at 156 Greenwich Street, Manhattan, where young men, physically sound, are wanted at once to take advantage of this offer of the city for a free education in two modern sciences—radio operating and aviation.

In this reserve aviation corps, in training and in active service, there are now four companies of officers and four of cadets, each company running to about one hundred men each. In the school there are always about two hundred young men in training. The enlistment period is for two years, the city furnishes the uniforms and all other equipment and gives to every cadet who finishes the course a thorough education in the mechanics of the gasoline engine, the science of aviation, piloting an airplane, radio telegraphy and telephony, meterology and kindred subjects. Upon graduation a cadet is equipped to operate any vehicle, either on land, sea or in the air, that uses a gasoline motor for propulsion. He has acquired a trade that is of inestimable value to him, no matter what part of the world he may be in, for there is no part of the civilized world at this time that does not use either one or all of the forces in which he is qualified to operate.

Every cadet is required to master radio in every detail before being assigned to training for flying. He is taught the international radio code from the ground up, until he is qualified to handle the high-powered radio sets employed by the Police Department in actual police work. Here he is taught, first, to send and receive radio messages from the ground, later, he is sent into the air with another cadet pilot and taught to send and receive from an airplane in motion. This instruction he receives directly from the hands of Captain Werther, who is a master of the science and a tactician of high merit.

Besides giving a young man a valuable education in a well-paid trade, this special reserve force educates in another manner. It takes the young man from the street corner, the pool room and the cigar store, where he may be led into temptation to violate the law and make of him a man, one who seeks to enforce the laws rather than to violate them. It teaches him discipline and self control, obedience to superiors and instils in him a pride in his work and in his knowledge of it. Under capable instructors he is taught swimming, boxing, fencing, wrestling, life saving; he plays baseball, handball and other athletic games, and is constantly developing under the instruction and influence of the environment in which others have advanced. From an embryo tough many a young man has been developed in less than the two-years' course into a clean living, healthy citizen of whom the city is proud.

The active personnel of the aviation division and radio corps under command of Colonel La Guardia consists of 102 flight and engineering officers and 160 cadets. It is through the generosity and public spirit of Rodman Wanamaker, Major John Gans, of Staten Island; Captain Theodore L. Bridgeman, Captain Paul Micellit of Sea Gate, and others, that this valuable service has been placed at the call of the metropolis free of cost to the taxpayers. It has cost a vast sum to maintain, but it has produced a corps of men trained in their art to such a degree that they will all be of priceless value to the federal government if they are ever called upon to defend it in time of need, at home or abroad.

Radiophoning from Airplanes

Radiophoning or radiotelegraphing from airplanes calls for the use of a ground wire connection just as much as it does when sending or receiving by wireless from stations on solid earth. Every neophyte knows that electricity travels in circles and that an impulse, once started on its career, keeps on going until it completes its circular course.

Every amateur, when he begins the construction of his home plant makes his ground connection as soon as he has his aerial erected. That completes the circuit and he is ready for the rest. But, suppose he erects his plant in a balloon and turns the bag loose, to drift at will. How is he going to maintain his ground connectioo with that sort of bird? How much worse, many ask, would it be if it were an airplane? How would it be possible to keep in contact with the ground when shooting above it at the rate of a hundred or more miles an hour? It is simple, if you know the sceret.

To Pierre Boucheron, of the Radio Corporation of America, *The Globe Radio Magazine* is indebted for details on this interesting subject of scientific research, given in an interview by Eugene S. Bisbee. In the first place, the air itself acts as part of the "ground" through which the current shoots on its way to and from the airplane equipped with wireless apparatus. The plane carries a trailing wire attached to its transmission set in the cockpit of the fuselage, but this wire doesn't touch the ground at any time, except by possible accident.

Such an accident might happen if the operator neglected to draw in the "ground" wire when near the earth, in which event there might be a catastrophe, for the wire is made of phosphor-bronze stranded cable, and is very strong and flexible. On its end it carries a weight of from one to three pounds or even more, depending upon the length of the trailer and the speed of the plane.

Equipped for radiotelephoning or radiotelegraphing, an airplane carries on its upper wings four insulated standards about a foot high, two on each wing end. These bear the aerial wires from which the messages are sent broadcast. The trailer extends from the body of the ship weighted as explained, for 100 or 150 feet. It is either let out when the 'plane has reached some altitude or is dropped gradually as the ship leaves the earth.

The length of the trailer for "ground" connection depends entirely upon the wave lengths with which the 'plane is operating, the average length being from 300 to 600 metres. From the apparatus in the body of the machine extends a metallic coil, at the end of which is the "ground" wire with its weight on the end. Messages sent to the flying ship from either the earth or another 'plane are caught on the end of the trailer and transmitted to the receivers of the telephone or telegraph on the head of the operator. The messages leave the machine through the aerials and return by way of the "ground" wire, thus completing the necessary circuit for all electric communication.

Radius of communication by airplane is of small importance, except at sea, the uses to which it is put being generally informative to the pilot of weather conditions on the surface. Twenty-five, fifty, or a hundred miles may be negotiated with an ordinary apparatus. This is sufficient to protect a 'plane travelling at the rate of more than a mile a minute or long enough to enable it to avoid danger during foggy weather or darkness.

Greater distances of communication require heavier apparatus, and this is a serious factor in flying. Small sized radio equipment is proportionately weaker than a large and heavy machine, carrying a heavier "ground" wire, and the noise and vibration of the powerful engines of an airplane prevent the operator hearing the weak signals that reach him from great distances. Up to twenty or thirty miles the signals received by an ordinary apparatus are strong enough to be heard distinctly above the roar and the rattle of machinery in the 'plane. Beyond this the electric impulse is too weak to break through the opposing forces and heavier apparatus is necessary for such work.

The vacuum tube is used with the transmission in the radiotelephone and the amplifier in the receiving end materially augments the sound of the signals. Yet the increase of distance operation must depend largely upon the makers of the motors that are used by the 'plane. Lessening of vibration and noise are more important than any other point, for weight in an airplane is a vital factor.

From a ground station an airplane may be directed by radiotelephone to a safe landing during a heavy fog that completely hides the surface of the ground. The pilot calls when he is within half an hour of where he assumes his station to be, say fifty miles away. During the succeeding

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thirty minutes the messages may be practically continuous and the 'plane directed accurately as it nears.

During the flights between the Florida mainland and the islands of the Bahama group the passenger is constantly in touch by radio with both points and with other flying friends who may be in the air at the time. The "ground" wires trail during the entire flight and are hauled inboard when the ships near the ground. It would never do to rip loose a palm tree from one of those beautiful pearly beaches or anchor the 'plane to a coral reef by inadvertently overloking the "ground" wire and its three-pound weight.

Loop Aerial Cuts Down Interference

How can any one living in an apartment house install a radiophone when the landlord refuses permission to put up an aerial on the roof? This is the most serious question that has confronted the radio fan since the big broadcasting stations commenced sending out a daily program of entertainment.

There are just two answers to this question, and both depend a great deal upon the location of the apartment house, its distance from the broadcasting station and the general conditions surrounding it. One is by means of an indoor aerial and the other by utilizing a so-called "loop" or coil aerial.

The latter is by far the best, because it not only can be used indoors, but it also has the property of cutting out interference to a maximum degree through its peculiar property of only recording signals when one of its edges is pointed directly at the transmitting station.

Its drawback lies in the fact that only a very small amount of current is picked up by it, and consequently it is necessary to use amplification in order to build up that current until it becomes audible in the telephone receivers.

The natural question which now arises in your minds, How can I build a loop aerial? I propose to answer this and then follow it up with a description of the manner in which a loop aerial is used. Before doing so, however, I want to point out that owing to the fact that most broadcasting stations are operating on a 300-meter wave there are many things which prevent us from taking the fullest advantage of present knowledge in connection with a loop, because of the difficulty of handling short waves and their terrific, high frequency.

A loop aerial suitable for reception of short-wave broadcasted music is best made in the following manner: Take two pieces of hard wood, six feet long and about three inches wide. Fasten them together in the middle, so that they are at right angles to each other. Next fasten a piece of hard rubber at each of the four ends, and groove the hard rubber so that it will hold the wire which is to be wound around it.

Upon the frame that you have now constructed it will be necessary to wind four turns of wire. For this purpose you will need seventy feet of 3x16x38 litzendraht cable. It will be necessary for you to wind this wire so that each of the four turns is spaced one-quarter of an inch from the others. This can be controlled by the grooves in the hard rubber.

When you have finished wiring this frame your wire will be square in shape. The two ends of the loop will come together at one corner of the loop. Cut off all the excess wire, leaving about three inches at each end for making connections.

You have now not only an aerial, but also an aerial tuning inductance of a fixed value. If you now place a variable condenser of .001 micro-farad capacity across the two ends of the loop your tuning circuit will be complete, although a little closer tuning can be obtained by placing a small variable inductance in series with the condenser.

The next thing for you to do is to drill a hole through the center of your frame, where the two cross-arms are connected. This should be large enough to carry a spindle which will support the loop on a stand and permit you to turn the loop around in a complete circle. This is very necessary, as you will have to turn the loop around until one of its edges is pointing directly toward the station you wish to listen to.

Use Regular Amplifier

After you have done this you will have to connect a vacuum tube detector and two stages of audio-frequency amplification to the two ends of the loop where you have the condenser joined across. The regular cabinet form of detector and two-stage amplifier can be used for this purpose.

For persons living within twenty-five miles of the broadcasting station, it will probably be found that satisfactory results can be obtained with a loop aerial using only a vacuum tube detector and without amplification, but local conditions will determine this to a great extent.

There isn't any question about the advantages of a loop aerial. It eliminates all interference, except that which emanates from some point in a direct line with the transmitting station. It also eliminates a great deal of static.

Where it is impossible to put up a loop because of the amount of amplification needed results may be obtained by using an indoor aerial. This can be done by laying 150 feet of No. 18 covered bell wire around the picture molding of a room and joining one end to the instruments where the outdoor aerial is usually attached. In this type of aerial a ground connection will be necessary, which, by the way, is not necessary with a loop aerial.

Reception by means of a loop aerial will be greatly improved as soon as effective means have been discovered for the application of radio frequency amplification on short waves. Radio amplification is very simple with very long waves, but no great success has yet been obtained with short waves. When it has it will be possible to use an indoor loop aerial almost anywhere in the country.

—*New York Tribune.*

New Charging Battery Works As You Sleep

Radio, the new national pastime, which already numbers its disciples by the hundreds of thousands, is stimulating immensely the popular interest in electricity.

Itself an electrical manifestation, it requires certain electrical equipment, and in some cases this equipment is arousing radio enthusiasts to the unique value of electricity to mankind in general, especially to home dwellers.

Undoubtedly this opening of the eyes, so to speak, begins through the necessity of charging the storage batteries used in radio sets. These batteries have to be recharged frequently, and if the radio operator was compelled to take the battery each time to a battery service station it would mean considerable trouble, expense and time.

Double Purpose

Hence the popularity among radio folk of gas-filled rectifiers for charging these batteries. And if the radio amateur is also an automobile owner, the rectifier has for him a double usefulness, since it will recharge the starting and lighting battery in his car as well as the radio battery of his receiving set.

To many radio followers this gives a big importance to the function of electricity in the home—a function that is many-sided.

Rectifiers originally devised for other uses are now finding new application in the radio field. The Tungar battery charger is a type of gas-filled rectifier in use for some years to recharge automobile batteries, and now developed to serve a similar purpose in recharging radio batteries.

This rectifier is made in various sizes, from small outfits intended for railway signal work up to large service station sets which will charge ten or twenty automobile batteries simultaneously. For radio work, however, the small, portable type in 2-ampere and 5-ampere capacities is the best for the purpose.

Familiar System

The electrical theory on which they operate is similar to that of the two-element vacuum tube with which the average radio fan is familiar. The essential part is a bulb, or glass tube, which contains a cathode and an anode. The cathode is a short tungsten filament and the anode —or, in terms of radio, the "plate"—is a graphite disc.

After being exhausted of all air, the bulb is filled with argon, an inert gas. This is the chief difference between the Tungar bulb and other two-element bulbs, such as the Flemming valve and the kenetron.

The vacuum tube depends for operation on the emission from an incandescent filament of small particles of negative electricity called electrons. The electrons themselves are the only current carriers, so that consequently the tube will rectify only a small amount of current at a comparatively high voltage.

In the case of the Tungar bulb, the electrons emitted by the heated filament ionize the gas, thereby making it conductive. This ionized gas acts as the principal current carrier, with the result that the bulb operates with a very much lower voltage drop (5 to 10 volts) and is capable of passing a current of several amperes.

The action of the bulb is similar to that of a one-way valve. During one-half of the cycle, electric current flows through the bulb from anode to cathode; that is, from the "plate" to the filament. But during the other half of the cycle, no current can flow. Hence the term "half wave" rectifier.

The 2-ampere Tungar will charge a 6-volt battery at two amperes, or a 12-volt battery at one ampere. The 5-ampere outfit will charge a 6-volt, 3-cell battery at five amperes, or a 12-volt, 6-cell battery at three amperes.

The Tungar is a product of the well-known research laboratories of the General Electric Company. Its use will enable the radio amateur to keep his receiving station always active. An inactive station is the one thing the radio fan abhors. If his set is out of commission for several days, because his battery has run down, he knows that he may miss some of the best air features of the season.

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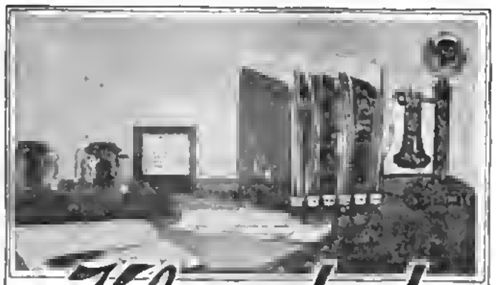

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(Continued from page 123)

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A layman can readily understand the great military power of modern air forces in the cases cited above.

Foreigners have not been first, nor are they alone, in recognizing the vital importance of air forces. Ten years ago Admiral Fiske declared that we could best defend the Philippines and our other foreign possessions by air forces. And Admiral Simms has recently asserted: "The command of the air means the command of the surface, whether it be sea or land. The experiment of sinking the Ostfriesland by aeroplane bombs proves that if our coast is protected by aeroplanes no ships can reach our shores or land troops."

Thus, the best authorities at home and abroad are of one mind—that air power will dominate in future war.

In the meantime what are we doing? Actions speak louder than words. In truth, it may be said that the United States is dawdling. The aviation bureaus of the army and navy are doing all in their power with the limited and crude facilities they possess, but their hands are more or less tied. Appropriations for aviation are insufficient and conservatism continues to place hurdles in its path.

Moreover, legislation and laws for the encouragement and regulation of civil aviation are held up. The Wadsworth-Hicks bill for Federal control of aeronautics, after passing the Senate, is being mangled, if not strangled, in the House by flaw-pickers and all sorts of seemingly jealous personal or bureaucratic influences. And little legal minds with states rights, personal rights and property rights preying upon them in this modern age, are supporting Farmer Brown in his claim that he owns all the air between his cow pasture and the moon, and that no trespassing aviator can fly through and breathe his oxygen without paying for it by the cubic inch!

Thus, while aviators are flying all over Europe, and when we are told that "a night air line between London and Paris will be in operation soon to carry the mails," when we are assured that "sleeping car aeroplanes will soon be in operation for tired business men who must cross the Channel quickly"—while all these advances are being made abroad the government of the United States appears to be asleep at the switch.

The need of prompt and intelligent action is imperative. Aviation, both in peace and in war, is already a dominating force. —Quarterdeck, in the N. Y. Tribune.

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AERIAL AGE WEEKLY

Vol. XV, No. 7

TABLE OF CONTENTS

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Amundsen's Aeroplanes

ROALD AMUNDSEN calculates that his drift on the Maude from Point Barrow, or thereabouts, to Norway by way of the North Pole will take five years. The distance from Point Barrow to North Cape, Norway, is about 2,500 miles. Captain Amundsen has just started in a metal monoplane for Seattle, which is some 3,000 miles from New York. It will be a flight with stops, but the distance could be made by daylight and a full moon in about thirty hours. The explorer naturally wants to learn how his new ship is sailed, for if he is to stand where Peary made his North Pole obserservations on April 6, 1909, the monoplane may be very useful. The drifting Maude should eventually shake herself free of the ice and emerge into blue water somewhere off the coast of Norway, unless the pack destroys her, but the chances of her passing very near the Pole are not bright. At some point the explorer would probably have to leave her and march or fly in the direction of the Pole.

There might be a risk in seeking the ship after a "dash" toward the Pole if it were necessary to depend upon dog sleds. The Maude might not move very fast, but if the explorer and his picked companions were absent from her for weeks there would be danger of missing her altogether. Polar weather is treacherous. It is easy to go wrong on the ice expanse; moreover, leads or open water may occur when explorers are at the end of their resources. Captain Amundsen wisely decided to take two aeroplanes with him, one for important flight work and another for scouting. The big metal plane has already flown in the Arctic Circle at very low temperatures. Both machines should be great time-savers if the Maude's drift carries her within quick flying distance of the Pole. It should be comparatively easy to pick her up after an excursion in any direction.

Admiral Peary foresaw the use of the aeroplane for Arctic exploration as long ago as 1912. In his book "The Secrets of Polar Travel" (1917), he said: "Five years ago at the annual dinner of the Explorers' Club I ventured the prophecy that in a few years the polar regions would be reconnoitered and explored through the air." He made his "drive" for the Pole from Cape Columbia on the northern coast of Grant Land, which is less than 500 miles south. He went on to say:

"From Cape Columbia it is less than 1,400 miles in a straight line directly across and over the Pole to Cape Chelyuskin on the Siberian coast, the most northern point of Eurasia. To Wrangell Island across Crocker Island and the entirely unexplored region between the Pole and Bering Strait it is about 1,500 miles. From Cape Columbia to Spitzbergen it is 900 miles, to Franz Josef Land less than 1,000 miles and to Point Barrow about 1,400 miles.

It is relevant to note that the metal monoplane acquired by Captain Amundsen has kept the air for more than twenty-six hours and has already flown from Mineola to Fort Norman in the Arctic Circle, 6,000 miles. It is conceivable that under favorable conditions this plane could be flown from Point Barrow to North Cape, Norway, with a stop in the neighborhood of the Pole, but Raold Amundsen is too experienced an explorer to face such desperate risks. The drift by the route the Melville-Bryant cask No. 2 was supposed to take is theoretically both safe and sure, and the North Pole can best be reached by an aeroplane in the hands of those who understand its limitations.—*Editorial in N. Y. Times.*

Air Transport in Europe

SINCE the war political and physical handicaps to railway travel in Europe have been tantamount to discrimination in favor of air transport, which knows neither the limitations of international boundaries nor the time consuming factor of overworked and in many cases decrepit rolling stock. The result of this unintentional though none the less real subvention of air transport has been the development, especially in France, of commercial flying services that already are in a fair way to rival the fast railway trains for passenger and express traffic.

The French Air Ministry reports that the distance covered by French commercial planes alone in 1921 was nearly 2,000,000 miles. Flights by these planes numbered 6,000, passengers carried were 10,330, merchandise freight weighed 366,278 pounds and postal matter 20,758 pounds. The figures for passengers and cargoes are three times as large as those of 1920 and ten times those of 1919.

There are eight companies in France operating air routes, which radiate in all directions from Paris. It is now possible to take off from the French metropolis in a plane of any one of the eight companies any day in the week and reach London, Amsterdam, Prague, Warsaw, Nice, Barcelona, Alicante, Malaga, Bilbao or Havre. In most cases the return trip can be made by regular service in a single day.

In 1922 the subsidy for the French commercial air service is 41,382,000 francs, or about $4,000,000. England comes second

(*Continued on page* 166)

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THE NEWS OF THE WEEK

National Flying Meet

New York—More than sixty aeroplanes have already been entered in the first of the national flying meets sanctioned by the Aero Club of America and the Aeronautical Chamber of Commerce which will be held at Curtiss Field, Garden City, L. I., N. Y., Sunday, April 30, it was announced.

The Rotary Club of New York is supporting the event which is designed to show the progress made in the development of American commercial aircraft during the last six months. Many new types will be flown in the various exhibitions and contests, which include races, speed trials, parachute jumping, efficiency and performance tests and passenger carrying. The Rotarians will have a special section reserved for them and their friends. It is the first of a series of such flying meets to be held throughout the United States this year, to demonstrate to the business and professional public the peculiar qualities of the flying machine in speed and economic operation.

In its announcement of the flying meet, the Aeronautical Chamber of Commerce points out that "while 275,000 persons traveled by air in this country last year—by far a larger number than in all Europe—the aeroplane is a difficult machine with which to demonstrate. Instead of driving up to his front door and inviting the business or professional man to take a ride, as is the custom with the motor car salesman, the man who would demonstrate an aeroplane must first get his audience out to the flying field where he can provide a close-up of the machines in actual operation." Through courtesy of the Curtiss Aeroplane & Motor Corporation, their field has been made available for the New York meet, which is the first of its kind to be held.

"With the co-operation of the Rotary Club and other organizations," reads the announcement, "it is hoped to put before the traveling and transportation public this year free aerial exhibitions which, because of the large scale with which they are presented, can not help but convince the average person that flying is a practical method of travel. It is believed that the meet at Curtiss Field April 30th will be as instructive as it is entertaining."

Two Airplane Hangars for Hartford

Hartford, Conn.—Two mail service aeroplane hangars offered to Hartford by the United States Post Office Department have been accepted by the Hartford Aviation Commission. The hangars will accommodate six planes and will be set up on the municipal aviation field here. Their erection is expected to be completed in May, and would facilitate a possible air mail service to New York and Boston in the future. The hangars were offered for a fraction of their cost, it was stated, to encourage aviation here.

National Advisory Committee for Aeronautics Meets April 20

Washington — A program for aeronautical research and development for the coming year will be considered by the members of the National Advisory Committee for Aeronautics at its semi-annual meeting, to be held in the Navy Building on Thursday afternoon, April 20.

The Committee, which is headed by Dr. Chas. D Walcott, is composed of independent and Governmental scientists and engineers. The scientific research and development undertaken during the past year in both civil and military aviation will be reviewed. Problems of aeroplane wing design, new developments in aeronautical engines, methods of testing aeroplanes, wings and parts, airship studies, lifting gases, aerial routes, the air mail service, and problems for the advancement of commercial aviation are among the subjects to be discussed.

Dr. Joseph S. Ames, Chairman of the Executive Committee, will outline the future plans of the committee with a view to placing America "foremost" in the development of aviation, as President Harding has recommended to Congress.

Dr. S. W. Stratton, Secretary of the Committee, will render a report on organization and the committee's activities in placing technical information on aeronautics where it will do the most good.

The development of a new type of aircraft engine with a view of eliminating the fire hazard by the use of heavy fuel oil in place of gasoline, will be among the subjects discussed. Special studies and tests of a new high-speed aeroplane wing, believed to be of great value in the interests of military scout planes, will be recounted by Dr. Ames. The allocation of the annual budget for special research problems will be discussed by the members.

During the sessions, Orville Wright and John F. Hayford, members of the Committee, will make a trip to the laboratory of the Committee at Langley Field to inspect the laboratory and make suggestions in connection with the tests and experiments contemplated.

Paul Henderson, the new Second Assistant Postmaster-General, who has charge of the Air Mail Service, has been invited to attend the meeting in view of his interests in aviation.

As an independent branch of the Government, the Committee holds itself in readiness to serve the President, the Congress and the executive departments in connection with aeronautical problems. The study of governmental aeronautical activities, recommendations for action under the International Air Navigation Convention concerning the development and regulation of civil aviation, and encouraging aeronautical engineering are among the duties of the Committee.

The members of the Committee expected to attend the meeting are:

Dr. Chas. D Walcott, of the Smithsonian Institution, Chairman.

Dr. S. W. Stratton, of the Bureau of Standards, Secretary.

Dr. Joseph S. Ames, of Johns Hopkins University, Baltimore, Md., Chairman of the Executive Committee.

Maj. Thurman H. Bane, Army Air Service, Dayton, O.

Dr. Wm. F. Durand, Leland Stanford Junior University, Calif.

Prof. John F. Hayford, Northwestern University, Evanston, Ill.

Prof. Charles F. Marvin, Chief of the Weather Bureau, Washington, D. C.

Rear Admiral Wm. A. Moffett, Chief of Naval Bureau of Aeronautics, Washington, D. C.

Maj.-Gen. Mason M. Patrick, Chief of the Army Air Service, Washington, D. C.

Dr. Michael I. Pupin, Columbia University, New York City.

Rear Admiral D. W. Taylor, Chief Constructor, U. S. Navy.

Orville Wright, Dayton, Ohio.

Spokane News

Spokane, Wash.—Raymond Small and George Stonebraker, of Lewiston, Idaho, are negotiating for airplanes to open an air route from Lewiston via Grangeville to the Chamberlain basin on the middle fork of Salmon river, for the accommodation of hunters who desire to visit that game region.

The distance between Lewiston and the basin is about 100 miles, and under present conditions the trip involves seven days of toil by horseback and pack saddle. Fuel for the final leg of the flight will be loaded at Grangeville.

To negotiate the trip planes will require to attain a height of 10,000 feet on leaving Grangeville, for in case of trouble the plane must return to Grangeville or glide into the basin.

It is planned to cross the Salmon river brakes at an altitude of 5,000 feet. The Salmon river gorge is about 9,000 feet. Passengers will be able to look down to the canyon 14,000 feet below. Chamberlain basin includes about 500 acres of meadow lands, affording good landings.

By a contract signed up with the Curtiss Airplane Corporation the United States Aircraft Company of this city is authorized agent of the Curtiss firm, and entitled to sell ships throughout the northwest, according to announcement made by C. H. Messer, head of the local concern.

"We will immediately put in a complete stock of parts for Curtiss ships and motors, as well as carrying the stock of Standard ship parts, as we do at present," Mr. Messer said. "This will give us the agency for ships and parts for the entire northwest. We will carry complete parts for every ship now flying in the district."

COMING AERONAUTICAL EVENTS

AMERICAN

- Apr. 30.—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
- May —National Balloon Race.
- Sept. 4 (*about*).—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
- Sept. 15 (*about*).—Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)
- Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

- Aug. 1 (*about*).—Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Venice.
- Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.
- Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

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The AIRCRAFT TRADE REVIEW

American Aeronautical Developments

Washington.—Some of the achievements in the progress of aviation in America will be revealed for the first time by Dr. Joseph S. Ames, of the National Advisory Committee for Aeronautics, in an illustrated public address in the New Building of the U. S. National Museum at 2:45 P. M., Tuesday, April 25.

Dr. Ames will review some of the remarkable scientific achievements of the Committee's laboratory at Langley Field, Va., and will describe and explain the operation of newly developed instruments for the determination of the characteristics of aeroplanes in flight, which will enable the designer and builder to design planes of particular performance characteristics, such as high speed maneuverability. New instruments developed at the Committee's laboratory indicate the pressure distribution over the surface of an aeroplane in flight including the control surfaces, the results of which will have an important bearing on the safety factors used in the construction of aeroplanes.

Two entirely new methods of determining aerodynamic properties of aeroplane wings such as lift and resistance, will be discussed by Dr. Ames: They are the trailing wing method and a new form of wind tunnel. Instruments for determining the stresses produced on aeroplanes when violently maneuvered, as in spins, barrel rolls, and loops will be shown and the results discussed.

Members of Congress interested in aeronautics have been invited to listen to Dr. Ames' remarks through the courtesy of the National Academy of Sciences, under whose auspices his address will be given.

Personal Par

Laureston Craig, former aviation instructor, and a former member of the advertising department of the New York Commercial, will sail on the steamer Finland, April 22nd for Russia, where he will be assigned to child feeding work of the American Relief Administration.

Mr. Craig, who is a native of Island Falls, Maine, was a member of the class of 1919 at Colby College, but he interrupted his studies to cnlist in the U. S. Air Service. Serving at Dorr and Barren Fields, he was made an instructor in aviation, and was later on duty at Carlstrom and Post Fields. Following his discharge from the army he resumed his studies at Colby College, graduating with the class of 1920. Since that time he has been in business in New York City.

National Balloon Race

The Aero Club of America announces that the American National Balloon Race will be held this year from Milwaukee on May 31, 1922, under the auspices of the Aero Club of Wisconsin. The following prizes are offered: 1st $1,000, 2nd $800, 3rd $600, 4th $300, 5th $200, 6th $100.

In addition to the above, $100 will be paid toward the expenses of each contestant who actually starts. The entry fee (for civilians) is $50 payable to the Aero Club of Wisconsin, to be returned when the contestant arrives at the starting field with his complete equipment.

The starting field (the Milwaukee Ball Park) is limited to approximately ten balloons, and applications for entry will be accepted in the order of their priority. It is expected that the Army will have three entries and the Navy three.

The three leading teams at the finish will in all probability be chosen to represent this country in the International Gordon Bennett Race which starts from Geneva, Switzerland, on August 6th.

All applications and requests for information should be addressed to the Aero Club of Wisconsin, 208 University Building, Milwaukee, Wis.

The Drag of C Class Airship Hull With Varying Length of Cylindrical Midships

A model of the C class airship hull, when severed at its major section and provided with a cylindric mid-body of variable length, had its air resistance increased about in proportion to the length of the mid-body up to 3 diameters, and in about the manner to be expected from the increase of skin friction on this variable length. For greater length the drag increased less and less rapidly.

As usual for such models, the drag for any fixed length, at 20 to 60 miles an hour, is accurately of the parabolic form $R V^n$ and hence the drag coefficient is of the hyperbolic form $C V^{n-2}$, where n is lightly less than 2.

The variation of C with length is stated in the conclusion.

A copy of Report No. 138 by A. F. Zahm, R. H. Smith and G. C. Hill, may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Michigan Airways Organized

The Michigan Airways has been organized in East Lansing, Michigan, to engage in aerial photography, aerial advertising and exhibition flying. Arthur J. Davis is president of the company and Talbert Abrams, vice-president. Mr. Davis was instructor at Kelly Field during the war and Mr. Abrams was associated with the Curtiss Company at Buffalo, New York, prior to the war and served in the Marine Corps during the war.

Localized Radio Landing Signals for Aeroplanes

Radio direction finders and other devices have been in use for some time to assist airplanes in landing during the night, fog, or at other times of poor visibility. The most usual method of employing radio for this purpose is to transmit from any ordinary elevated antenna at the landing field radio signals which are received on a direction finder carried by the airplane. Sucn a method gives the direction of the landing field but does not tell accurately the distance from the plane to the field.

Several years ago the Bureau of Standards was called upon to develop a method to assist airplanes in accurately locating the landing field when the airplane was quite close at hand. A method was desired which would give a signal heard over a comparatively large area when the airplane was at a high altitude but would be localized within a small area when the plane was near the ground. A method employing a large horizontal coil tuned to 500 cycles was tried but did not prove satisfactory. The use of radio frequency waves was, therefore, undertaken and two horizontal coils, one above the other, with current flowing in opposite directions, were used. A fairly high radio frequency, such as 300 kilo-cycles, was employed in this case.

A calculation was made which indicated that the signals radiated from the 2 coils would be the strongest for an airplane flying in a given horizontal plane whenever the airplane was within a comparatively small ring-shaped area located above the landing field. The results of these calculations were verified in practice.

The Bureau of Standards has just published a paper giving the theory of the radiation from an antenna consisting of 2 horizontal coils such as that described above. The area within which the signal is heard and the point at which it is most intense are discussed. The results of these investigations are given in Bureau of Standards Scientific Paper No. 431, "The Field Radiated from Two Horizontal Coils," which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy.

First Pursuit Group to Hold Meet

The First Group (Pursuit), now stationed at Ellington Field, will celebrate its Organization Day (May 5th), this year, with flying and athletic activities on May 5th and 6th. This celebration will be worth while to induce anyone interested in aviation to travel across the country to witness it.

An invitation is extended by the First Group (Pursuit) to all persons interested in air activities to be present at Ellington Field, Houston, Texas, on those dates.

The following events will be a part of the program:

1. Flying: Aeroplane races of every description; exhibition of aerial combat, aerial acrobatics, gunnery, bombing and acrobatic formation flying; exhibition of various types of aeroplanes, motors, maintenance equipment, and flying training equipment.

2. *Athletics*: Boxing bouts, baseball games (Ellington Field vs. Kelly Field), volley ball championship game, track and field meet.

It is especially desired that all Ex-Service Pilots be present as every Air Service Station in this vicinity will have a large delegation at Ellington Field, and the event will be a reunion and gathering of Air Service friends.

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REACHING THE STARS BY AEROPLANE

Being the Tale of Movie Luminaries Who Have Succumbed to the Lure of "Giving 'er the Gun!"

By CHARLES L. GARTNER

ONE of the dreams of the average movie fan is to gain an interview with his or her favorite star; to sit down in a quiet little corner and ask all the intimate questions he or she has wanted to for a long time. But, to the layman, most of the screen lights are harder to reach than a bank president during a Bolshevik riot. Only in exceptional cases does the admirer of the silver sheet get a chance to get in personal contact with the luminaries of the silent drama.

One of the surest ways, figuratively speaking, of getting the ear of a star, is to mention aeroplanes. Almost the entire movie colony in Hollywood is aeroplane struck. Directors, stars, scenario writers, authors and even cameramen are aviation enthusiasts, many of them being licensed pilots.

Betty Compson, star in Paramount Pictures

What may come as somewhat of a surprise to many movie fans is that Mary Miles Minter, one of the youngest and best known of the ingénues on the screen today, has qualified for a license as pilot. Miss Minter successfully passed the test over a year ago but parental objection has prevented her from taking advantage of her pilot's card. She is not permitted to ascend with the controls in her own hands.

Cecil B. DeMille, director-general of the Famous Players-Lasky Corporation, is one of the pioneers of aviation in the motion picture center of the world. Mr. DeMille, for a long time, was part owner of a passenger aeroplane company which made regular trips from Hollywood to nearby cities. He is also one of the most prominent figures in aviation on the coast and often takes his "bus" out for a few dips and tail spins in order to forget the cares of his office. Mr. DeMille asserts that there is no better tonic in the world for "that tired feeling."

Dorothy Dalton, star in Paramount Pictures, is another ardent advocate of the "travel by aeroplane" slogan. Miss Dalton's specialty is hydroplaning, for she much prefers the water route than the solid earth below.

A more recent addition to the ranks of the flying stars is Betty Compson, the girl of "The Miracle Man" fame. Although kept extremely busy out on the coast Miss Compson manages to find an occasional hour or so every few days to devote to the thrills of flying. Miss Compson has yet to win her pilot's license but hopes to secure the coveted card before she is many months older.

But perhaps the most enthusiastic, for aviation, of the movie people on the coast is Jeanie Macpherson, scenario writer for Paramount Pictures. Miss Macpherson has been flying for at least three years and is one of the most prominent aviatrices in California. She numbers among her acquaintances many of America's leading aviators, and she has participated in more "stunt" and "circus" flying than any other person connected with the motion pictures who is not paid for risking his or her neck. She has made a number of trips with Ormi Locklear, world famous "stunt" man, from whom she learned many of the finer points of the art of flying. The news of Locklear's tragic death some time ago came as a genuine shock to her.

Speaking of Locklear, Miss Macpherson said, "Ormi Locklear was, to my mind,

Jeanie Macpherson, scenario writer for Paramount Pictures

a natural flyer. His judgment in the matter of height, and in that of keeping the plane level, was uncanny. I remember one trip I took with him out on the coast in which he took me out to sea. We unexpectedly ran into a dense fog. I was frightened to death, as we could hardly see each other, but Locklear, without even bothering to consult his instruments, kept right on going, and when he thought we had gone far enough he turned his machine and headed back again.

"If I had had the machine there is no doubt that I would have been flying for Canada, Mexico or the open sea, but in a short time we were out of the mist and to my great surprise, and greater relief, found that we were headed straight for our own landing place. I believe Locklear, with that sixth sense of his, could fly his 'boat' in the dead of night, without a light to guide him, and get through safely. That's why I can't understand some of the reports which were circulated about Locklear losing control of his machine on a difficult loop."

Eddie Rickenhacker, America's famous ace, is another close friend of Miss Macpherson's. In fact, Rickenhacker was Miss Macpherson's tutor at one time.

The writer knows of a little incident that shows Miss Macpherson's love for flying. Some time ago Miss Macpherson came East preparatory to sailing for

Gloria Swanson and C. B. DeMille witnessing an aerial circus

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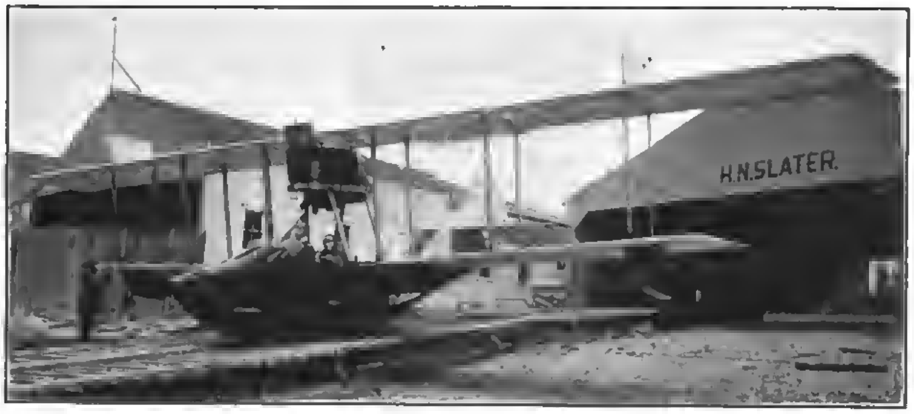
Europe for a well deserved vacation. As is the case with all motion picture celebrities of the motion picture world, a great deal of Miss Macpherson's time during her short stay in New York City was taken up by interviewers from newspapers and magazines. One interviewer, who had been in the flying corps overseas, had been pumping Miss Macpherson on the cut and dried subject of scenario writing. The conversation was lagging when the gentleman in question suddenly looked at his watch and mentioned the fact that he would have to leave as he had an appointment with some one at the Aero Club. That proved to be the opening wedge for a conversation that lasted far beyond Miss Macpherson's dinner hour and incidentally, long past the time set for the appointment at the Aero Club. Needless to say, the subject discussed was aeroplanes and, much to the surprise of the ex-service man, Miss Macpherson spoke fluently upon the respective merits of aeroplane motors of foreign and domestic make. The writer can testify to the above fact, for he had to sit through many weary—to him—minutes of technical descriptions of the Hipsano-Suiza, Liberty, etc. Than which, to the layman, there is nothing more complex.



Dorothy Dalton, star in Paramount Pictures

AEROPLANE WILL CARRY SUSPENDED WING IN TEST

A FULL-SIZED aeroplane wing suspended below an aeroplane in high speed flight will shortly be tested at the Langley Field Laboratory of the National Advisory Committe for Aeronautics. This will be the first time that a real wing has been tested in actual flight, and is the final step of developing a new method of testing the performance and lifting properties of aeroplane wings.

This new method was developed by the National Advisory Committee for Aeronautics, which is composed of 12 American scientists who devote a large part of their time to the solution of aeronautical problems—without compensation. The method recently demonstrated successfully with model wings in air flights, consists in carrying the wing to be tested below an aeroplane in flight and, by means of suspension apparatus and recording instruments, to measure the forces of lift and resistance directly from the wing.

A complete aeroplane cannot be tested in flight as there is no means nor method of measuring the factors desired; there is nothing to suspend the plane from and its lift or pull cannot be measured by instruments carried on the plane itself.

Heretofore tests of new wings have been made in one of the following manners: Years ago, Dr. S. P. Langley used a whirling arm which carried a small model of the wing at its extremity; the Wright Brothers and many others used the wind tunnel method, which consisted in placing a model of the wing in a tunnel-like structure through which a draft of air was forced; later a method was devised for carrying a larger model of a wing above a motor vehicle or railroad car.

All of these methods, while giving interesting results, have been found lacking in the accuracy desired in the design of aeroplanes. The information available to a designer should be sufficiently accurate to enable him to predict the ultimate actual performance of a wing on a full-sized aeroplane. In the whirling arm and the wind tunnel methods of test, errors were found to exist due to the small size of the model that could be tested; while in the method of carrying the wing above a vehicle, the interference of the ground and the wind was responsible for the inaccuracy. In short, the reason that no one of these methods proved entirely satisfactory is that the method and equipment used did not even remotely approach the actual conditions of flight.

It was with this in mind that the new method was evolved, in which every detail has been arranged so that the test conditions are as close to the conditions of actual flight as is possible. Under the new method a model wing is constructed to full size and the conditions of test as to speed and altitude of flight can be selected to suit the aeroplane in which the wing is intended to be used, and the qualities of its lift and resistance can be measured directly without an overburdening amount of mathematical calculation. In the preliminary tests of the new method using small models several difficulties were met and overcome and the results obtained are encouraging to the extent that the testing of full-sized wings is in preparation.

The new method consists in suspending the wing to be tested upside down below an aeroplane in flight. It is supported by three steel wires at such a distance that there is no interference from the aeroplane or from the "wash" of its propeller. The wing is inverted so that the lift becomes a downward pull, keeping it away from the aeroplane, and the amount of the pull being equal to the lift when right side up. With the wing so suspended it is possible to measure its lifting force on spring balances directly through the suspending wires, and its resistance from the angle of these wires to the vertical. This, on its face, appears of little difficulty, but as it would be obviously impossible to leave the ground or to land with the model hanging below the aeroplane, it was necessary to take off with the wing hauled up against the plane and to devise a means of raising and lowering the model wing after the plane was in the air. It was in perfecting this apparatus that considerable difficulty was experienced, and twice while in flight the model got beyond control and broke away on one occasion, colliding violently with the tail surface causing considerable damage and threatening the destruction fo the aeroplane in the air and loss of life to the test pilot and engineer. However, remedial changes were made in the apparatus and more careful handling of the wing has reduced this hazard to a minimum.

The method was originated by F. H. Norton, Chief Physicist in charge of aeronautical research at the National Advisory Committee's Laboratory, and the preliminary tests were carried out by him with the assistance of Thomas Carroll, Test Pilot of the Laboratory staff. Twenty flights have been made with the perfected apparatus carrying a model wing six feet long by one foot wide, and the results obtained have checked with remarkable accuracy with the known performance of the full-sized wing of similar proportions upon a full-sized aeroplane.

The testing requires calm air conditions to give the best results and the flight path must be in a straight line. For the purpose of demonstrating the possibilities of the method, however, several flights were made on days when the air conditions were far from ideal and turns made with the wing suspended. It is possible to vary the angle of the model wing to the wind by raising or lowering the rearward suspending wire and the angle is read, with the aid of a telescope, from a small inclinometer or spirit level attached to the model. As the model is carried from twenty to thirty feet below the aeroplane, it is necessary to reel in the suspending wires until the model is close up to the body before a landing may be attempted. It has been found that in gliding onto the field at customary speeds, forces are developed by the model which are nearly capable of tearing it loose. This has been easily corrected by approaching the ground at lower speeds.

While these experiments developed by the National Advisory Committee for Aeronautics are of a preliminary nature they have excited considerable interest among aeronautical men both at home and abroad. The results of the experiments upon the full-sized wings are eagerly anticipated, in the hope that they will solve the problem of providing the aeroplane designer with absolutely accurate performance data, at less cost than for inaccurate data heretofore obtainable.

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THE "UNIVERSAL PROPELLER"

By DAVID L. BACON

Langley Memorial Laboratory

THE improvements in aeroplane performance and fuel economy which may be realized by the use of a variable pitch propeller are unquestioned and their more frequent use, particularly on supercharged and multi-engined aircraft, has been delayed principally by the lack of satisfactory designs.

The reversible propeller also has shown decided advantages in decreasing the run of aeroplanes on landing and in the maneuvering of airships.

The helicopter problem which has for centuries been a fertile field for inventors is now attracting more serious attention than ever before and offers attractive possibilities if the obstacle of very large propellers, variable in pitch and of extremely light weight, can be successfully overcome.

A new design which avoids some of the objectionable features of other reversible propellers is therefore of more than passing interest.

At the request of the National Advisory Committee for Aeronautics the "Universal Propeller" was operated and explained by the inventor, Mr. Spencer Heath, for the purpose of demonstrating the following features of its design.

1. Elimination of continuously running gears, collars or bearings in the pitch control mechanism.
2. The use of engine power in place of manual labor in changing the blade angle.
3. The absence of any structural limitation to the range of blade angles available and the possibility of limiting the blade travel between any two predetermined extreme positions.
4. Continuous indication on the instrument board of the blade position.
5. Autnmatic throttling of the engine while the propeller is passing through the position of neutral pitch.

Description of Propeller

The present propeller and operating mechanism represent an experimental development rather than a refined design and as they were built entirely to shop sketches, no scale layout could be obtained and the writer's accompanying sketches are necessarily crude and incomplete.

The two wooden blades are fastened into steel sleeves which in turn are held in a steel hub similar in construction to that used by Hart and others, the centrifugal forces being taken on ball thrusts and torsional and axial forces on plain bearings.

The method of fixing the wooden blades into the steel sleeves is noteworthy. The butt end of each blade is tapered outwardly at a small angle as shown in Fig. 1, and the surrounding collar is split so that it may be first sprung over the butt and then compressed upon the taper.

Pitch Changing Mechanism

The pitch changing mechanism is operated through the application of a braking force to either one of a pair of small brake drums surrounding the engine crankshaft and normally rotating with it. The elementary principle is shown in Fig. 2, which represents a brake drum connected through a gear train to the individual blades of the propeller. It is apparent that if the drum is allowed to revolve at crankshaft speed, all the gears will be stationary relative to the propeller and that the pitch angle will remain constant. If, on the contrary, the brake drum is held stationary the gear train will he set into action and the pitch angle of the blades will undergo a continuous change until the brake drum is released.

In order to change the blade angle in the inverse direction a second brake drum may be used, connecting to the worm shaft through an idler which serves to reverse the direction of rotation of the worm shaft. It should be noted that during normal flying none of these gears are operative and that the blades are locked in position by the non-reversible features of the worm and the friction of the connected parts.

The actual construction of the pitch changing mechanism used by Mr. Heath is shown in Fig. 3. It will be seen that the mechanism has been somewhat complicated by the necessity of obtaining a large speed reduction ratio between the brake drums and the propeller blades. The brakes are applied through leather faced aluminum shoes operated from the pilot's seat by a light push and pull knob attaching to a brake lever mounted on the drum housing. A small hand crank is provided

Fig. 1. Split steel sleeve compressed about butt end of propeller blade.

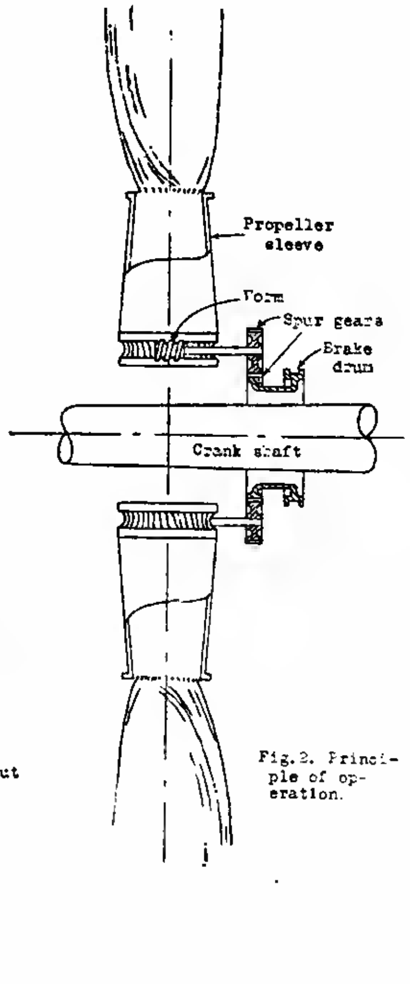

Fig. 2. Principle of operation.

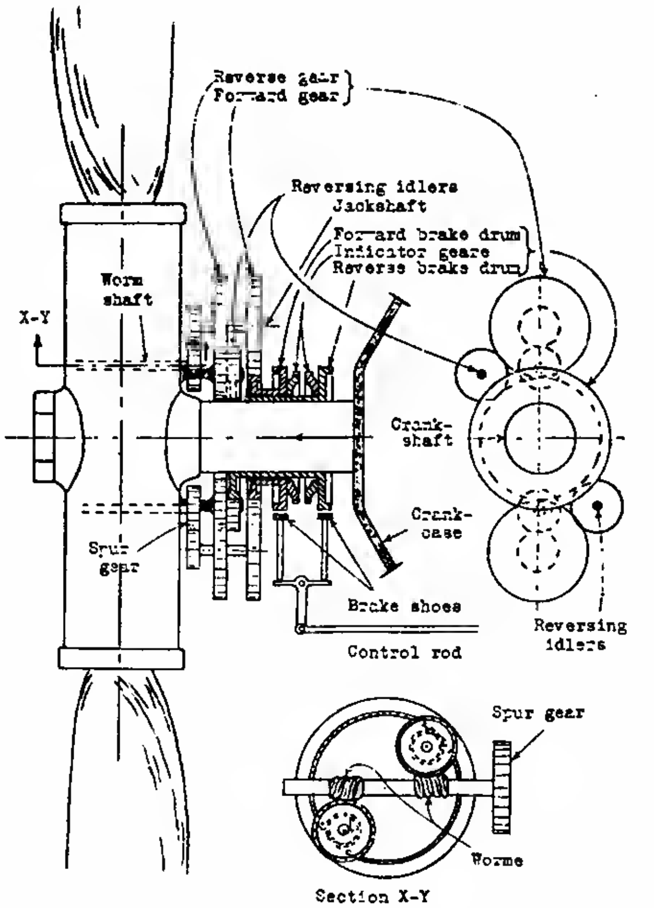

Fig. 3. Pitch changing gear train.

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by which the pitch can be changed while the engine is not running.

Blade Position Indicator

The angular setting of the propeller blades at any instant is a function of the relative motion which has taken place between the two brake drums. The indicating mechanism is therefore operated by gearing from the two brake drums which conveys differential motion to the indicating pointer and the throttling and pitch limiting cams. As long as the two brake drums revolve both at crankshaft speed the indicating hand remains stationary while if either of them is retarded an angular motion is shown on the indicator equal to that experience by the blades themselves.

Automatic Throttle Control

The mechanical throttle is provided with springs in both directions so that the pilot can at any time by applying a force on the throttle greater than the initial tension in the springs substitute manual for automatic control.

Pitch Limiting Mechanism

In the pitch limiting mechanism the control knob normally connects to the brake levers direct, a push increasing and a pull decreasing the pitch. If the control button is held in either operating position until the limiting position of the propeller blade is reached the cam trips a latch plate and renders the control inoperative in that direction while leaving it ready for use in reversing the direction of propeller blade motion.

Demonstration Under Power

To show the action under power the propeller and related mechanism were installed on a 150 HP Hispano-Suiza engine mounted with gasoline tank, observers' seats, etc., on a lumber trailer weighing about two tons which was free to roll on the ground between two chocks a few feet apart. The engine and propeller were operated both by Mr. Heath and the writer and put through their entire range of performance, which included disconnecting the pitch limiting mechanism so that the blade angles were controlled throughout a complete revolution of 360 degrees, both forward and reverse.

With the engine turning at about 1,000 r.p.m., the angular change from full speed ahead to full speed astern was accomplished in about five seconds.

Conclusions

The present mechanism, although but a crude embodiment of the inventor's principle, fulfills his claims at listed at the beginning of this report, and might easily be redesigned into a practical flying accessory.

It is obvious that some of its advantages are gained at the expense of additional complication and the question immediately arises whether they are worth it. In the opinion of the writer the novel features of this propeller are of sufficient value to warrant its redesign in a compact and lighter unit for prolonged service tests on either aeroplanes or airships. Any pitch changing mechanism for use on a helicopter must necessarily be designed as an integral part of the structure, and it remains to be seen whether designers will care to use Mr. Heath's patented ideas or will prefer to undertake the additional and by no means simple task of inventing and perfecting some mechanism of their own.

PUBLICITY BY AEROPLANE

By ANDRE CARLIER*

of the Compagnie Aérienne Francaise

No one can now foresee the new applications which circumstances may any day bring forth for the utilization of the aeroplane aside from commercial transportation. We must try to discover them, as the only means of assisting aviation to live. One of the most important branches of aerial activity is publicity by aeroplane. It may assume various forms and has already been employed with marked success.

In the first place, aerial photography will henceforth constitute one of the resources of every publicity agent for any large company. Why? Because the most natural desire of a chief of industry or a wise manager is to show the world that his factories exist, that they are in perfect order and that they cover a respectable area. Twenty years ago there were artists who specialized in this kind of illustration, with the aid of photography. With great difficulty, by climbing to the top of a chimney, they obtained a more or less successful bird's eye view. Everybody has seen on catalogs these pretty pictures with diminutive people on the ground and delivery wagons larger than the buildings themselves. Though some were well done, most of these pictures were infantile.

We know a celebrated factory on the Marne, the manager of which did not hesitate, at the time of the Chicago exposition, to build a wooden tower, 60 meters (nearly 200 feet) high, in order to obtain a single panoramic photograph. At that time there were no aeroplanes.

Now all the large manufacturing plants have in their files superb aerial photographs taken at an altitude of 500 to 800 meters and showing their establishments from all sides.

These views serve alike for illustrations in catalogs and for letter heads. They can be reduced for making post cards or enlarged for placing in waiting rooms or offices, or for decorating the stands at the next fair or exposition.

These panoramic photographs show in a striking manner the designs of our castles and parks, and will constitute the best advertisements for our architects.

. Aerial photographs will serve to advertise estates and building lots and each one can select his lot without visiting it, because the real estate company will have in its office the field itself, with its trees, its meadows, its brooks and rivers and all shown in relation to one another much better than on the estate itself.

They will be of service to engineers in planning factory extensions.

This will be the best way to exhibit in other countries the beauty spots of our own country, either by the use of lantern slides or by a collection of handsome enlargements.

Publicity by aerial photography will not stop here. Magazines and newspapers will resort to it more and more. After the catastrophe at the Baden Aniline Works, "L'Illustration" immediately requested the "Compagnie Aérienne Francaise" to send one of its operators by aeroplane to take aerial photographs of the ruins. In 48 hours the aeroplane departed, the photographs were taken and the negatives delivered to the journal which published, the following Saturday, a large double-page picture of the catastrophe.

Aeroplanes are coming daily into more extensive use, not only for taking aerial photographs but also for the rapid transportation of pictures taken by ground photographers. The "Daily Mail" employs no other means for transporting its photograms and kinetograms.

Another method of advertising by aeroplane is to drop circulars, either directly or with the aid of parachutes. Experience has demonstrated that all papers falling from the sky are immediately picked up and religiously carried away by the person who is able to get possession of them. In order to add interest to this method of advertising, it is evidently necessary to drop a large number of circulars, for a few thousand do not make much show. On the contrary, when a million or two circulars of all colors are dropped on a city or any large gathering, inside of half an hour, the effect produced is enormous. If, in order to increase this effect, a thousand parachutes, weighted with any kind of advertisement, are dropped, the crowd simply goes wild to get hold of them.

This method of advertising is of interest not only to manufacturers of products of wide consumption, like food and pharmaceutic preparations, etc., but also to large banks for arousing interest in popular loans. The Crédit Lyonnais resorted to this method at the time of the last government loan. Our aeroplanes, in fact, can come into direct contact with the thrifty man in his provincial city, in his village, and even, if necessary, in the fields and at his plough.

All these methods of publicity can be made still more effective by assembling, in advance, several thousand people at the same place, which is the object of the "Reunion Aérienne." These "aerial gatherings" may last one day or several, or even a week, like the one recently held at Dinard by the D. R. P. (League for the defense and rehabilitation of the country,) which was a great success.

An excellent advertisement for an exposition or a fair is the organization of an aerial taxi service between the city and the grounds. The Germans showed a perfect understanding of this fact, when they organized during the last Leipzig fair, an aerial service between that city, Berlin and the other large cities of Germany.

The promoters of the Lyons fair are considering a similar plan for next year.

From what we have seen, we may conclude that the employment of the aeroplane for advertising purposes is still in its infancy and that, by constant collaboration with other means of publicity, such as the daily papers, bill-boards, etc., results may be obtained, the importance of which it is still difficult to estimate.

(*Translated by the National Advisory Committee for Aeronautics.*)

* From "Premier Congrès International de la Navigation Aérienne," Paris, November, 1921, Vol. II, pp. 147-149.

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HYDROSTATIC TEST OF AN AIRSHIP MODEL

An airship model made by the Goodyear Rubber Company, was filled with water and suspended from a beam and the deformations of the envelope studied under the following conditions:

(a) Both ballonets empty;
(b) Forward ballonet filled with air;
(c) Rear ballonet filled with air;
(d) Both ballonets filled with air.

Photographs were taken to record the deflections under each of these conditions, and a study was made to determine the minimum head of water necessary to maintain the longitudinal axis of the envelope under these conditions. Additional photographs were taken of the model filled with air and after filling with water before any adjustment of the suspension was made. The form of the cross section when filled with water was obtained by bending a heavy piece of fuse wire to conform with the surface and then by laying the wire on paper and tracing the shape. The effect of filling with water on the length of the model was also noted.

Apparatus Used.—As may be seen, from the following photographs, the model was suspended from a framework in front of a vertical screen of cross section paper having lines one inch apart. The tension in the cords was adjusted by screwing up the nuts on the ⅛-inch brass rods which ran through the beam, as shown in the photographs. The lower ends of these rods were bent to form hooks into which the cords were tied.

Conditions of Test.—Six cords on the end, both forward and rear were run to a single ring and fastened. In this test they were run through the ring in order to provide for adjustment of each cord. The rings were held in place by a wire, which may be seen in the photograph, and which was fastened to the Vee, at the end of the third cord from the end on each side. When filled with water an upward force was exerted near the stern at the position occupied by the rudders and fins on the airship. The weight of the fins and rudders on the full-size airship is 480 pounds. The forces acting on the model are $\frac{1}{30.18}$ times those on the full-size airship; hence this upward force was made $\frac{480}{30.18}$, or 15.9 pounds. This force was measured by supporting a stick at its middle on a knife edge and hanging a weight of 15.9 pounds on one end; while from the other end, as is shown in the photographs, the stern of the model was suspended. It will be noted that the moment exerted by this force, tending to tip the stern up, is $\frac{1}{30.18^2}$ times the moment of the rudders and fins on the full-size airship, and as the cords were adjusted to a length equal to approximately $\frac{1}{30.18}$ times that of the full-size airship, the moment of the weight of the model about the ends of the cords near the beam is $\frac{1}{30.18^2}$ times the moment in the full-size airship; hence the moment exerted by 15.9 pounds is correct in this report. It may also be shown that the stress in the fabric caused by this moment is the same as in the full-size airship. The flat sticks under the band were simply to distribute the force of the band in a way similar to that in which the force of the fins and rudders is distributed in the full-size airship, and to prevent the band making a deep indentation in the model.

The entire apparatus was mounted on platform scales in order to determine the change in weight under the various conditions.

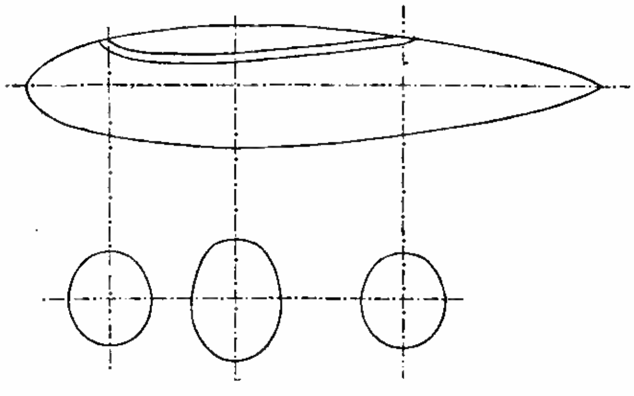
The pressures used were measured by manometer tubes, as shown in the photographs, and were as follows:

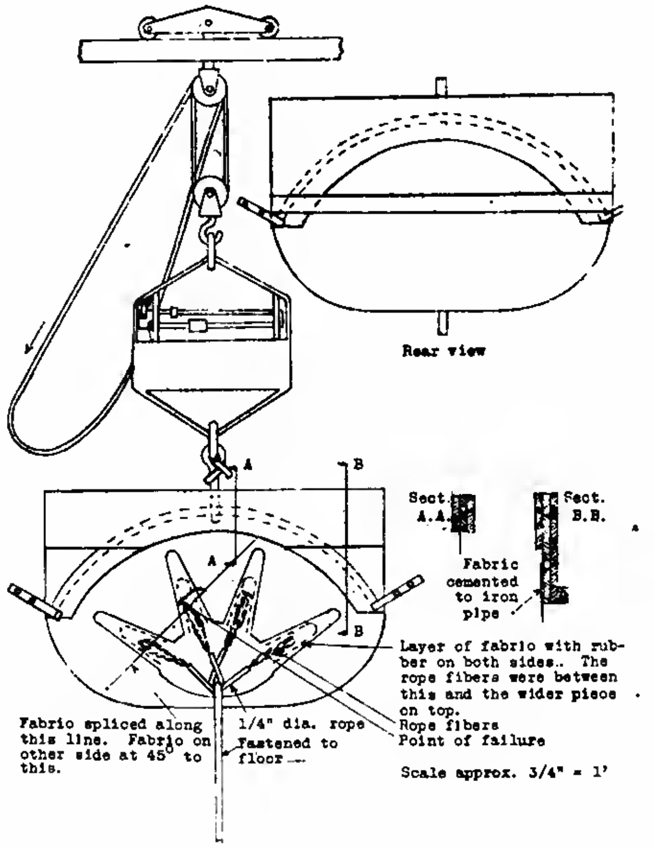
Pressure of air (air filled) ....19½ in. water
" " water (water filled) .... ¼ " " (approx.)
" " air in forward ballonet.....20 " "
" " air in rear ballonet.........20 " "
" " air in both ballonets
(used together)...........15 " "

The pressure of the air when air-filled was made 19½ inches because about this pressure was necessary to straighten out the wrinkles and give the model a fairly smooth appearance. It was assumed that the same pressure would hold the ballonets in shape, and hence it was used. Due to a leak in the connections when both ballonets were filled the pressure had dropped to 15 inches when the picture was taken. This was considerably in excess of the water pressure on the outside of the ballonets, hence they must have been completely filled in all cases. One-quarter of an inch of water was used as this was the smallest amount that would indicate with certainty that the model was filled. A slight change in the air pressure occured constantly, due to the cooling of the air after compression and also as a result of leaks, caused the water level to change slightly, requiring that a slight head be used to make sure that the head did not become less than zero. Considering that the fabric in the model might take the form of that in the full-size airship, a quarter-inch head, equal to a probable increase of ¼" in the vertical distance from top to bottom of the envelope, was taken as zero head.

Correction for Readings on Cross-Section Paper.—The lens of the camera was kept at a constant distance of 200 inches from the screen, measured in the path of the light. As the distance from the axis of the model to either screen was 9 inches, the actual dimensions of the model may be determined

* This report is a slightly revised form of the unpublisher Report No. 22, Construction Department, Navy Yard, Washington, D. C.





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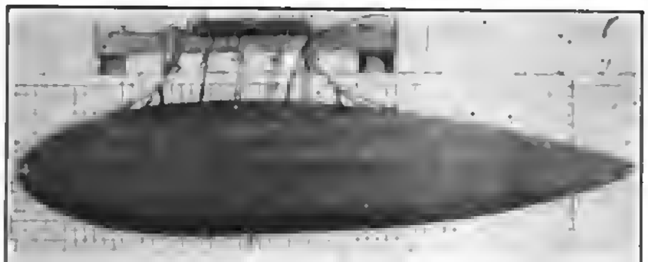

Fig. 3. Filled with air.

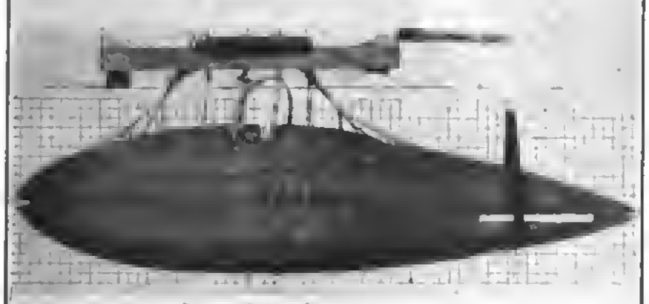

Fig. 4. Filled with water (not adjusted).

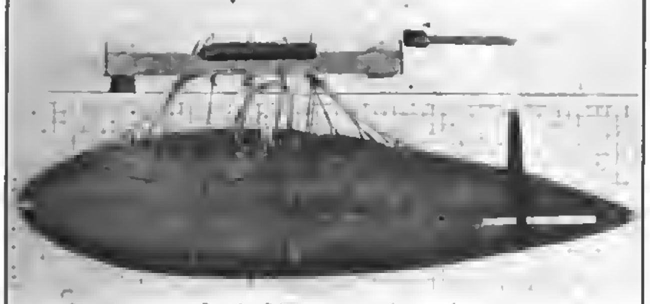

Fig. 5. Filled with water (adjusted).

for any point on it by reading the dimension on the cross-section paper and reducing it by the ratio $\frac{200-9}{200} = .955$. If a greater accuracy is desired, a correction for the inaccuracy of the paper should be made; the actual width being 1911 inches instead of 20 inches. The correction lengthwise will be by the same ratio, of course.

Discussion of Photographs

Filled With Air.—Fig. 3 shows the model filled with air and was the first one taken. The model had stood for several days filled with water, and it presents a much smoother appearance than when first filled with air before standing filled with water. It was found necessary in order to bring the model to a horizontal position to support nearly the entire weight by the cords furthest to the right to those which appear vertical in the side view. The other cords were drawn up as far as possible without causing any appreciable tension.

Filled With Water (not adjusted).—Fig. 4 shows the model filled with water, no adjustment of the cords having been made after taking the photograph, Fig. 3. It will be noted that the stern had sagged more than the prow and there was an off-set in the axis under the rear end of the belly band. The vertical cords toward the rear were too tight, causing a narrow section to show from a top view. It is not only the cords which took the weight when air-filled, however, that were too tight, as those just ahead of them appear equally stressed. The foremost of the cords passing through the rear ring caused an indentation and for this reason they were removed from the ring before the next picture was taken. The indentations around the ballonet valves were due to the fact that the cords attaching the ballonets to the envelope were too short. The wavy appearance of the sides was due to the seam and most of these waves did not extend much beyond the seam. The waves in the belly band took the form shown accidently, and did not indicate that the cords would cause a similar form on the full-size airship.

Filled With Water (adjusted).—The following adjustments were made before taking photograph, Fig. 5. Numbering from the stern No. 3 cords were taken out of ring and adjusted, which caused the position of the ring to change. Nos 1 and 2 were taken up about 1 inch; No. 5 was let out about ¼ inch. The rear cords were not tightened more because of the wrinkle which began to appear just under their upper ends and because tightening them threw the cords, which appeared in a vertical plane in the plan, more and more out of the vertical. The axis of the model was, however, straightened considerably in this way, as may be noted.

Forward Ballonet Filled With Air.—The principal effect of filling the forward ballonet with air, as shown in photograph, Fig. 6, was to tip the forward end up and to broaden it, the broadening being chiefly due to the increased tension in the cords holding the ballonet. The model at the same time moved forward as is shown by the increased inclination of the cords. Due to some peculiarity in the lighting, the liquid in the tube did not register clearly, but the pressure was about 20 inches of water. The tension in the rear vertical cords was increased, as is shown by the tendency to wrinkle on the sides under them.

Rear Ballonet Filled With Air.—Filling the rear ballonet with air, as shown in photograph, Fig. 7, had the same effect as that in photograph, Fig. 6, except that it was at the other end while the dent under the beam toward the rear end which disappeared in photograph, Fig. 6, reappeared here. The cords in the middle section swung to a vertical plane, those farthest forward taking the greater tension.

Both Ballonets Filled With Air.—In this condition, shown in photograph, Fig. 8, the axis was in nearly the same position as with both ballonets empty, except that the stern was higher by about 1½ inches. The cross-section at each end when the ballonet at that end was filled was of this form.

It was noted from a plan view that the filling of either of the ballonets with air distorted the stream line form considerably.

Force Exerted by Ballonets is of Proper Magnitude.—That the buoyancy of the air in the ballonets is of the proper magnitude, i. e., $\frac{1}{30.18}$ times the negatve buoyancy of the ballonets full-size airship, is evident from the following reasoning. A ballonet from the full-size airship immersed in water would have 909 times the buoyancy in the opposite direction, but the ballonet in the model has $\frac{1}{909 \times 30.18}$ times the volume of the

(*Continued on page* 158)

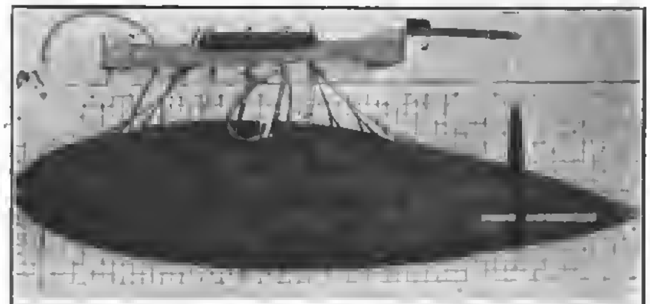

Fig. 6. Fore ballonet filled with air.

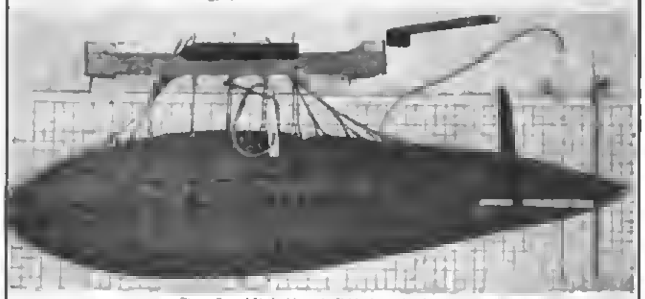

Fig. 7. Aft ballonet filled with air.

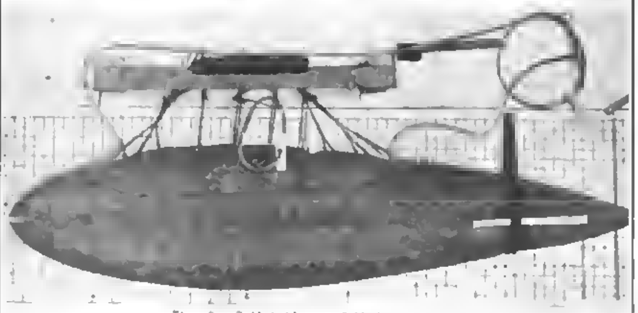

Fig. 8. Both ballonets filled with air.

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Investment Value for You
May and

Ordnance Material Includes:

Machinery; Machine Supplies; Tools; Chemicals; Iron; Steel; Copper; Brass; Building Supplies; Power Equipment; Electrical Supplies; Fr. and Br. Tanks; Shell Cases; Shrapnel Cases; Cartridge Cases; Shell Boxes; Motors; Pumps; Boilers; Raw Materials, Miscellaneous.

Quartermaster Material Includes:

Clothing and Equipage, comprising: Underwear, Socks, Shoes, Caps, Gloves, Shirts, Blankets, Sheets, Towels, Bed Sacks, Barrack Bags, Textiles; Subsistence; Harness and Leather; Vehicles; Hardware; Mess Equipment; Office Equipment; Raw Materials; Miscellaneous.

This Buyer's Guide Points the Way

Date	Place	Sales Method	Materials Offered	Send for Catalog to:
May 2	Houston, Texas	Sealed bid	J-1 Airplanes	Chief, M. O. & S. Sec., Air Se[rvice], Room 2824, Muniti[ons] Bldg., Washington, D. C.
May 4	Rock Island, Ill.	Sealed Bid	Ord. Material	Salvage Officer, Rock Island A[r]senal, Ill.
May 4	Atlanta, Ga	Auction	Q. M. Supplies	C. O., Q. M. Intermed. Depo[t], Atlanta, Ga.
May 5	Buffalo, N.Y.	Sealed Bid	Lumber	Chief, M. D. & S. Sec., Air Se[r]vice, 2824 Munitions Bld[g.], Washington, D. C.
May 8	Morrison, Va.	Sealed Bid	Airplane Hangars	Chief, M. O. & S. Sec., Air Se[r]vice, Room 2824, Muniti[ons] Bldg, Washington, D. C.
May 9	Houston, Texas	Sealed bid	Aero Engines	Chief, M. D. & S. Sec., Air Se[r]vice, Room 2624, Muniti[ons] Bldg., Washington, D. C.
May 9	Fairfield, Ohio	Sealed bid	Castor Oil	Chief, M. D. & S. Sec., Air Se[r]vice, Room 2824, Muniti[ons] Bldg., Washington, D. C.
May 9	Jeffersonville, Ind.	Auction	Q. M. Supplies	Q. M. S. D., Gen. Intermed. De[]pot, 1819 W. Pershing R[d.], Chicago, Ill.
May 10	Erie Proving Grounds	Auction	Ord. Material	C. O., Erie Proving Ground[s], Erie, Pa.
May 11	Chicago, Ill.	Auction	Q. M. Supplies	Q. M. S. D., Gen. Intermed. De[]pot, 1819 W. Pershing R[d.], Chicago, Ill.
May 16	New Cumberland, Pa.	Auction	Q. M. Supplies	Q. M. S. D., Gen. Intermed. De[]pot, 1st Ave. & 59th St[.], Brooklyn, N. Y.
May 18	Philadelphia, Pa.	Auction	Q. M. Supplies	Q. M. S. O. Gen. Intermed. De[]pot, 1st Ave. & 59th St[.], Brooklyn, N. Y.
May 22	Nitro, West Va.	Auction	Ord. Material	Charleston Industrial Corp., Nitro, W. Va.
May 25	Atlanta, Ga.	Auction	Q. M. Supplies	C. D. Q. M., Intermed. Depot, Candler Warehouse, Atlanta, Ga.
May 31	Brooklyn, N.Y.	Auction	Q. M. Supplies	Q. M. S. O., Gen. Intermed. De[]pot, 1st Ave. & 59th St[.], Brooklyn, N. Y.
June 1	San Antonio, Tex.	Auction	Q. M. Supplies	Q. M. S. D., 8th Corps, Ge[n.] Area Depot No. 2, Ft. Sa[m] Houston, Texas.
June 6	McClellan, Ala.	Auction	Q. M. Supplies	Commanding Officer, Atlanta [Q.] M. Intermed. Depot, Candle[r] Warehouse, Atlanta, Ga.
June 8	Camp Jackson, S.C.	Auction	Q. M. Supplies	Commanding Officer, Atlanta [Q.] M. Intermed. Depot, Candle[r] Warehouse, Atlanta, Ga.
June 13	Camp Grant, Ill.	Auction	Q. M. Supplies	Q. M. S. O., Chicago Gen. Inter[]med. Depot, 1819 W. Per[]shing Rd., Chicago, Ill.
June 15	Chicago, Ill.	Auction	Q. M. Supplies	Q. M. S. D., Chicago Gen. Inter[]med. Depot, 1819 W. Per[]shing Rd., Chicago, Ill.
June 19	Camp Sherman, O.	Auction	Q. M. Supplies	Q. M. S. O., Chicago Gen. In[]termed. Depot, 1819 W. Per[]shing Rd., Chicago, Ill.
June 22	Boston, Mass	Auction	Q. M. Supplies	Commanding Officer, Boston [Q.] M. Intermed. Depot, Boston, Mass.
June 27	Norfolk, Va.	Auction	Q. M. Supplies	Q. M. S. O., N. Y. Gen. Inter[]med. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.
June 29	Brooklyn, N.Y.	Auction	Q. M. Supplies	Q. M. S. O., N. Y. Gen. Inter[]med. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.

WAR DEP

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In the War Department's June Sales

Every sale holds real investment VALUE for somebody. To take advantage of the opportunities offered by these sales there are several well defined steps you should follow. First—Write for catalogs of sales that interest you. Second—Make a study of the wide range of commodities listed. Select those items on which you will want to bid. Third—Send your own representative, or instruct someone to act for you.

You will see in the list of War Department Sales the location and dates of sales of the various materials. This outline will assist you in planning to take advantage of those sales most important to you.

For further information regarding all War Department Surplus Property Sales, write:

MAJOR J. L. FRINK

Chief, Sales Promotion Section, Office of Director of Sales

2515 MUNITIONS BUILDING, WASHINGTON, D. C.

Future sales in project include:

AIR SERVICE MATERIAL:

Curtiss Elmwood Depot, Buffalo, N. Y.; Long Island Engine Plant, N. Y.; Americus, Ga.; Richmond, Va.; Morrison, Va.; Montgomery Repair Plant, Ala.; Chapman Field, Fla.; Carlstrom Field, Fla.; Dorr Field, Fla.; Park Field, Tenn.; Selfridge Field, Mich.; Fairfield, Ohio; Love Field, Texas; Houston, Texas.

ORDNANCE MATERIAL:

Amatol Ordance Reserve Depot, N. J.; Amatol Village, N. J.; Erie Howitzer Plant, Erie, Pa.; Picatinny Arsenal, N. J.; Aberdeen Proving Grounds, Maryland.

QUARTERMASTER SUPPLIES:

El Paso, Texas.

ARTMENT

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(*Continued from page* 158)
times the volume of the full-size airship ballonet; hence the force which it exerts is $909 \times \frac{1}{909 \times 30.18} = \frac{1}{30.18}$ times the force exerted by the full-size airship ballonet; hence the ratio is the same as for the other forces.

Relation of Stresses in Model to Those in Full-Size Airship.—The reason for making the model $\frac{1}{30.18}$ scale was that under this condition the stress in the fabric when filled with water is equal to that in the full-size airship when filled with hydrogen. A proof of this is given in the note following the data. The weights of the hulls, however, act in opposite directions in the two cases. In the full-size airship it causes no tension on the cords and increases the tension in the fabric on the top. In the model the weight is taken by cords and the stress in the fabric just outside of the belly band is increased. This difference may be eliminated by placing a rubber tube filled with air inside the model. It was impossible to place this tube inside this model, however, without making an aperture in the envelope, which was not thought desirable nor necessary as the weight of the hull was very small compared with the weight of the water, whereas in the full-size airship it is much greater compared with the buoyancy.

Action When Partly Filled.—In order to obtain additional data to aid in deciding as to the pressure to be recommended, additional tests were made as follows: Water was drawn from the water-filled model with ballonets empty until the tail collapsed, due to the rudder and fin weight. This occured when the level of water was about two inches below the inside edge of the belly band. To bring it to this level about 1/3 of the total weight of the water was drawn off. On the following day this part of the experiment was repeated at which time the level was brought 3½ inches below the inside edge of the belly band before a collapse occured. This difference in results is explained by the fact that when the model is only partly filled it is in an unstable condition. If for any reason the water starts to run toward one end, that end becoming heavy sinks while the other rises, and the water rushes to the lower end. The first day that this part of the experiment was made, when a level of two inches below the inner edge of the belly band was reached, the water began to run forward and a collapse occured. The second day it started to run in the opposite direction, a crease developing under the rear filling valve which became 1½ inches deep before the water began to run the other way and a collapse occured.

Action of Rudder and Elevator Forces.—It was calculated that at 45 miles per hour and with the rudder at 30°, the force on the rudders for a model of this size would be about ¾ of a pound, and the force on the elevators would be approximately the same for this condition. However, as the other forces are 30.18 times those, correct to scale, for a model of this size, the rudder and elevator forces must be increased in the same ratio; hence a weight of 22½ pounds was used to represent the total pressure on the rudders, and the same weight was used to represent the total pressure on the elevators. The effect of hanging this weight on when with a head of ¼-inch (ballonets empty) was to deflect the stern about 8½ inches. When exerted sidewise the deflection was about one foot. Under a head of 10 inches the deflection was about 3½ inches down and five inches sidewise.

Action With Rudder and Fin Weights Removed.—A head of 10 inches was then put on the model, and the rudder and fin weights removed. The axis was not bent noticeably due to this removal, although the inclination was of course changed. The head was then decreased and the axis gradually bent until at one-inch head it had bent so that the stern was about five inches lower than with the 10-inch head, and it was also bent to the left about six inches and there was a fold in the fabric on the left side and bottom about 1¼ inches deep under the rear filling valve.

Change in Volume With Pressure.—Under the 10-inch head the weight was 483 pounds, an increase of about 4 per cent in net weight over that for ¼-inch head. However, there would be a much greater percentage increase in buoyancy in the full-size airship due to this increase in head.

Cross sections of the water-filled model with ¼-inch head are shown on Fig. 1. As previously stated these were obtained by bending a heavy fuse wire around the model. The tracing thus obtained was then reduced by the pantograph to the size shown in the figure. As noted above, the form when the ballonets were filled was with a valley on the under side. As this was due chiefly to the ballonet cords being short and would not occur to the same degree in the full-size airship, no reproduction of the cross section, when the ballonets were filled, was made.

Conclusion.—From the above it appears that any pressure sufficient to keep the airship full may be used. No data was obtained which could be used to determine to what extent the wind would affect the deformation. But it appears that a pressure of one inch of water would provide a suitable factor of safety, and therefore this is the pressure recommended. Due to the negative buoyancy of the ballonets, a pressure of about 0.4 of an inch of water in excess of the pressure used on the hydrogen is necessary to equalize the pressure inside and out at the top of the ballonet. This difference between air and hydrogen pressures should be increased to probably at least ¾ of an inch to compensate for the weight of the ballonet and for the tension on the cords.

DIMENSIONS OF MODEL

	Condition	Dimensions in Inches
Length	Air filled	61.4
	Water filled, not adjusted	61.1
	Water filled, adjusted	61.0
	From specifications: $\frac{1}{30.18} \times 160 \times 12$	63.6
Maximum diameter	Air filled, actual	13.4
	From specifications: $\frac{1}{30.18} \times 31.5 \times 12$	12.5

WEIGHTS OF MODEL
(Including Apparatus)

How Filled	Pressure in Model	Pressure in Ballonets	Weight in Pounds
Air	19½"	None	311
Water	¼"	"	476
"	¼"	Forward, 20"	461
"	¼"	Rear, 20"	455
"	¼"	Both 15"	439
"	10" head	None	483
"	——	"	422 *
"	——	"	403 **

Short Proof That Stress in Fabric in Model Equals That in Full-Size Airship.—This proof is based on the fact that in a model made exactly to scale throughout, the stress per unit area, in any number, is the same as in a full-sized airship, if the pressure per unit area of the liquid remains unchanged at all points. This is the case, however, that the head of the water is rightly chosen, both pressures are the same function of the height. This necessitates in addition that the liquid used in the model have a greater buoyancy (positive or negative) than that used in the full-size airship, and if the thickness of the fabric in the model be reduced by the ratio $\frac{1}{n}$, which is the scale of the model, the buoyancy of the liquid used must be n times that of the hydrogen, but if it be not reduced, the cross sectional area of the fabric in any plane is n times as great as it should be to cause the desired stress with a fluid having a buoyancy n times that of hydrogen. Hence, in order to cause the stress in the fabric of the model to equal that in the full-size airship, it is necessary to make the buoyancy of the liquid n times as great as it would be if the thickness of the fabric were to scale. The ratio of the buoyancy of the liquid to be used, to the buoyancy of hydrogen, is therefore n^2. The ratio of the buoyancies of water and hydrogen is 909. The scale to be used is then $\frac{1}{\sqrt{909}} = \frac{1}{30.18}$. The negative sign is not introduced in connection with the buoyancy of water

* At point of collapse, first trial; level of water 2 inches below inside edge of belly band.

** At point of collapse, second trial; level of water 3½ inches below inside edge of belly band.

Weight of water which model should hold, calculated from displacement given in specifications (77,000 cu. ft.) $= \frac{77,000 \times 62.4}{30.18^3} = 175$ pounds.

Weight of water actually held by model at 10-inch head = 483 lbs. — 311 lbs. = 172 lbs.

(*Continued on page* 166)

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The Beautiful Sky Below

The call of cloud-blown space may claim you,
  Where sifting sunbeams set the world aglow.
The pall of the lonely void may awe you,
  As drifting shadows cross the earth below.

The thrill of it all may wing you beyond
  Where ages have bade man call a halt.
Its beauties may enhance your gift of gab,
  Where lobbies hear you fly it to a fault.

But;
You and I, and the rest of the guild,
  When the crate falls into a spin,
Think less of the beautiful sky above
  Than what's left of the sky we're spinning in.

So, the azure dome and its infinite span
  Are yours (things O. K.) for mind's romance.
Yet, you'll glory more in the last few feet,
  When you've just won out on a long shot chance.

A. A. C.

Why Pick on Aeroplanes?

Every month there are thousands killed, by automobiles,
These days it happens so often, that we take it like our meals.
Railroads mangle & kill, their victims by the score,
'Tis such a common occurrence, we don't mind it anymore.
Constantly by the street cars, there are scores killed,
They jump the track & smack one black, keeping hospitals filled.
The news "paupers" bought & supported, by these two industries,
Say scarce a word of all these things, for fear of getting a freeze.
A short time ago a foreign balloon, not an AEROPLANE,
Blew up & the papers of the world, chucked it in every brain.
On a basis of passengers carried, & actual miles flown,
'Tween autos & planes for-safety, the Planes take the bone.
Statistics have been handed, to the shyster newspapers,
And they refused to publish them, specialy the auto's capers.
But let an accident happen, to an Aeroplane,
The newspapers of the world, shout it in loud refrain.
Because 'tis such a scarce thing, & also such good news,
To bring to them from the public, all their coppers loose.
From railroads & auto manufacturers, it also brings fat dues,
Just like the old proverbial, the golden egg'ed goose.

H. T. Haller.

Clouds

By Contact

As I go thru the sapphire ways of the air
And over the mosaic maps below,
My thoughts often turn to the clouds floating by
And I wonder at them as they come and go.

Their fleecy shapes of silver white
I see on days so fair.
These faithful wanderers of the sky
Are my companions of the air.

And along thru the endless trails of space.
The snowy shapes go floating by
Slowly, peacefully, undisturbed
Save for my plane that roars on high.

Then, oft I have seen them as peaceful sheep
In the pathless meadows of the sky,
And have lightly touched their curving shapes,
In the course of my flights which have carried me high.

And before me I've seen them in one sullen mass
As if to bar me and my powerful flight!
Then I immerse my ship in their misty shapes
And find myself lost in a sea of white.

Between, above and below the wings
Come ghostly opals in lazy flight
Blown by the four winds of the sky
On thru the day and on thru the night.

Will You Remember?

1

Heart of gold, before the sun is high
  And a plane travels through the golden sky
While the sun from east, with golden gleam
  Goldens your house, mountain and stream.
From up high small appear human dens,
  And morning peace thralls the souls of men—
Heart of gold! do you remember then?"

2

And when you see a plane high in eastward flight,
  And thunderstorms darken day into night,
When lightning forces its way to ground
  And everything toward shelter is bound,
When a bolt will light up cattle and pen
  And ghostly fears will shroud the souls of men—
Heart of gold! will you remember then?

3

When sometimes you'll see a drowsy sky
  Remember the flight we had, you and I?
We were flying over those mountains and trees
  It must still live in your memories—
The cattle were grazing behind the pen
  And peace went into the souls of men—
Heart of gold! will you remember then?

B. K. R.

The Call

Do you ever have a longing to get in the air again
  And to face the same old dangers like a reg'lar flying man?
Do you ever have a yearning just to try your luck once more
  Rather facing thunder and lightning than to be inside that door?
Do you ever sort of hanker for a rough and ready trip,
  Just to prove you're still a living and you haven't lost your grip?
Do you ever get a feeling being cramped and useless here,
  Making figgers while you shine your pants upon an office chair?
Do you ever pass a paintshop, and so get the smell of dope?
  Know the time that you were trying getting it off your hands with soap?
Do you ever pass a field; getting the castor oil odor,
  Don't you wish to have the stick in hand and a roaring motor?
Don't you ever wish to be back just for one more flight,
  Just once more in the game again and a real aerial sight,
If not for any particular reasons, give your friends the laugh
  And so show the roaring element that you still can stand the gaff.
If you don't, then heaven help you and you sure are dying then,
  You might once have been a pilot but never a flying man.

B. K. R.

Johnny: "The camel can go eight days without water."
Freddy: "So could I if ma would let me."

Winner at a Glance

Algy: That vulgah puhson mistook me for a racing man.
Sally: How was that?
Algy: He said I won the Brown Derby.—*Stanford Chaparral.*

"Cheese, sir?" inquired the waiter.

"Certainly," replied Besse. "Catch me a Limberger!"

The waiter made a grab at the sideboard and seized one in the nick of time.

"Now catch me a Gorgonzola!" said Besse.

Grappling with it violently, the waiter brought it over.

"Now," said Besse, "let 'em race across the table to me and I'll take the winner."

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FOREIGN NEWS

Laws and Regulations Governing Aerial Navigation in Italy

The Division of Civil Activities of the Office of the Chief of Air Service from time to time will publish bulletins on the laws, regulations and provisions governing aerial navigation in Italy. The object of this publication is to furnish to all persons and companies interested in aerial navigation the laws and regulations governing this matter that are in force at the present time.

The following is a translation of Circular 0005322, establishing the rules for the employment of the term "Air Route" for telegrams and phonograms:

For the purpose of insuring continuous communication between air ports, in the transmission of news relating to the movements of aircraft, in compliance with the agreement made between the Ministry of War and the Ministry of Post and Telegraphs, the latter, on special behalf of air navigation, has allowed the form "Air Route"—already in use for telephone communications—to be extended also to State telegrams which, therefore, will enjoy the absolute precedence over all other telegraphic correspondence.

1. The term "Air Route" shall be used for communicating only the departure or arrival of air-craft, convey news to the interested Headquarters concerning important incidents to air-craft during their journey (landing outside their stations), to communicate important meteorological information in connection with air navigation, calls for assistance, etc.

2. All notices regarding the movements of air-craft in navigation shall be transmitted by telephone which shall be considered as the most preferred, quickest, and normal means of communication. Therefore, a telegram bearing the wording "Air Route" shall not be transmitted except when it has not been possible to convey the communication by telephone.

3. The permission to use the form "Air Route" in telegraph and telephone communications is granted only to the regular commanders of air posts, fields, repair depots, naval air stations and, during their absence, only to those persons designated by them.

4. The permission referred to in the above paragraph is extended to the Commanding Officers of the Royal Carabineers when they must convey information regarding the landing of air-craft outside their field. In such cases the form "Air Route" shall be used only for the transmission of telegrams to the air port interested in the case, as the communications to other offices must be transmitted by the ordinary means.

5. The same permission is granted to corporations or private parties engaged in aerial navigation. Such concession is, however, subject to the following conditions:

a. To possess the Ministerial Decree conferring the right to carry on aerial navigation services;

b. To carry out such right on private fields, their own property, and when duly authorized, and when there is no governmental representative, for in this case the permission is granted only to the latter;

c. To have requested (on stamped paper of Lire 2) and obtained a written authorization from the Ministry of War (Comando Superiore di Aeronautica—Division of Civil Activities) which will, if necessary, notify the Ministry of Posts and Telegraphs and the Telegraph and Telephone Office having jurisdiction over the territory wherein the field is located;

d. To pay from time to time the relative fee for urgent telegrams and phonograms;

e. That in their application they will make a declaration of their readiness to pay the fines mentioned in the Concession for using aircraft, also for every non-compliance with the rules of this circular.

6. The rare and rational use of the form "Air Route" shall be exercised with the utmost scruple, so that the permission granted may not generate into an abuse but remain in the very strict limits allowed.

7. In every air port, field, depot, naval air station, there shall be kept a special register for telephone correspondence or telegraph communications transmitted with the wording "Air Route." Such record book shall contain the progressive number, date, hour of the communication requested, the hour in which the communication has been granted, the address and the text of the telegram or phonogram, references, name of the employees who transmit or receive the communication.

On such record book the text of the telegram or phonogram shall be written and signed by the same parties to whom the concession has been granted.

8. Any abuse whatever in the use of the form "Air Route" will be punished by disciplinary measures and the payment of the expense, if the abuse is committed by a Government Official; by a fine, as referred to in Art. 5, (6) and by the immediate revocation of the concession in case of private corporations.

Italian Aeronautics

In order to establish more rapid communications between Italy and Tripolitania, the Secretary of the Colonies, Hon. Girardini, is endeavoring to organize an aerial mail service from Rome to Tripoli that may eventually be used also for the transportation of passengers. In this way the Superior Command of Aeronautics, which is occupied by every interest in the technical side of the problem, has granted the use of the magnificent dirigible "Esperia" to make its first flight, which will take place in the coming Spring. In the meantime, while they are completing certain works in order to prepare the aeroplane for her flight, her commandant, Maj. Velle, will go to Tripoli personally to make sure of a safe landing.

Meanwhile, the Assistant Secretary of the Colonies, Hon. Verino, has inspected the dirigible "Esperia" at the port of Ciampino. She was built especially for the civil service, and besides carrying a load of mail she may also carry twenty passengers, each with 55 lbs. of baggage, on a long trip, offering them the accommodations of a railway parlor car.

Following the votes expressed by the Aero Club of Naples, through its General Secretary, Mr. Maisto, in the recent meeting of Directive Council of the National Aeronautical Federation in Rome, the International Aeronautical Federation at its last meeting in Paris has decided that the International Race for the "Trophy of the Sea Aviation, Jacques Schneider," will take place in Naples in the latter part of August. The great race will be part of an International Week of Hydro-Aviation, which will embrace also the contests for the "Great Trophy of the Tirrenean Sea" (created by the Superior Command of Aeronautics) over a circuit of 1,260 miles touching several ports of Sicily. Prizes aggregating about 300,000 lire will be awarded to the winners of the various events.

Spanish Appropriations

A Reuter dispatch from Madrid states that the Spanish Minister of War has submitted to the Cabinet a proposal providing for the appropriation of 175,000,000 pesetas for the creation of an aer force of 10 squadrons, consisting each of 18 machines of average size and of six "giant" machines for bombing purposes.

Night Flying Express

The first air express to be fully equipped for night flying left the London Air Station for Paris recently. This machine, the Farman Goliath "Verdun", with accommodations for thirteen passengers, is used regularly now by the Grands Express Aeriens on their daily service between London and Paris. In addition to softly shaded lights in the saloon, red and green electric navigation lights are fixed on the extreme tips of the wings, and a bright rear light is fitted to the tail. Two powerful electric searchlights are placed in the center of the machine below the passenger cabin, and light up the ground over which the aeroplane is flying. The electricity for all this lighting is supplied by two dynamos, which are driven by tiny windmills rotating rapidly in the wind produced by the aeroplane as it rushes through the air. Four powerful magnesium flares are suspended in pairs below each lower wing tip, and the pilot lights these by electricity as he approaches the ground, thus making landing at night an easy operation.

Production in Germany

The work of disarming Germany in the air is ended, according to a correspondent of the London *Daily Mail*. All but 20 of the British, French, Italian, Belgian, and Japanese officers, who have worked under General Masterman on the Inter-Allied Commission of Aeronautical Control, have left Germany. On May 5th the Commission will cease to exist.

Since January, 1920, when General Masterman arrived in Germany, the Commission has destroyed 14,800 airplanes. Of 29,500 motors dealt with, some have been handed over to the Allies, but most of them have been destroyed. Six airships have been handed over to the Allies.

The work of the Commission has been done under great difficulties; never before had the work of disarming a nation been undertaken. When General Masterman demanded a list of places where sheds, works, and airplanes were to be found, the authorities declared that the papers had been lost during the revolution. Only little by little was the necessary information collected.

General Masterman's work is ended, but the control of civil aviation in Germany is to continue. The Council of Ambassadors has not yet published the regulations to be imposed. It is certain that there will be a small permanent Commission with the right of inspection to see that manufacture is carried out within the lines to be prescribed for future German aircraft.

Aerial Touring in North Africa

The first pleasure tour by air across French North Africa, according to Mr. Edward A. Dow, American Consul at Algiers, Algeria, has been undertaken by Mr. Lucien Sharp, of Providence, R. I., an American citizen, now residing temporarily in Paris. Mr. Sharp came by air from Europe to Casablanca, making the journey from that point to Marrakech, Morocco, thence to Oudjs. From the latter point he came directly to Algiers, arriving there January 28th. On January 30th he proceeded to the border of the Sahara Desert at Biskra and Touggoart, and intends continuing his journey by air to Constantine, in Algeria, Tunis, thence to Sicily, Rome, Athens, Constantinople and Western Europe.

The voyage was undertaken in a De Haviland (English) Biplane, and the pilot is an Englishman, Mr. Alan Cobham. There is said to be space for only three persons in all.

Military aviation is being studied in French North Africa. New posts have been established in the interior of Algeria, at Hassi-ba-ba and Laghouat, each about 165 miles from Algiers.

It is proposed in France to endeavor soon to establish aerial tours from Algiers to the desert at Biskra and Touggart, and another cross-country line from Gabes and Tunis, in Tunisia, to Algiers; thence to Oran, Algeria, and Casablanca and Agadir, in Morocco.

A German dirigible "Nordatern" was recently turned over to the French Government, and after repairs have been made, and stations built, it may be placed in operation between Marseilles and Algiers.

Policing Iraq by Aircraft

Sir Percy Cox, High Commissioner of Iraq, made his first inspection by air of part of the country lying along the Euphrates on March 21, when he visited Fahad Beg Ibn Hadhdhal, Sheikh of Amarat, at his headquarters, about 30 miles N.W. of Hit. He was accompanied by his staff and a Royal Air Force guard of honor.

The party, we learn officially, left Baghdad in three Vickers 'Vernon' machines, one of which also carried stores for armored cars, with an air escort of 12 machines.

The Amarat, who are well armed and number 5,000 rifles, range the eastern half of the Hamad as far north as Dair az Zaur. The tribe is regarded as friendly to the British. The effect of the visit and the demonstration of air power by the assembled aircraft, and of machine-gun fire by armored cars, which were also present, is reported to have been very impressive. The flight, which covered about 300 miles out and home, partly following the course of the Baghdad-Cairo air line, was accomplished successfully on the day of the inspection, by the 15 machines engaged.

The Vickers "Vernon" machines which were used for conveying the official party are twin-engined troop-carrying aeroplanes that have been sent recently to Iraq to augment the air units stationed there, and are destined to take an important part in the garrisoning of this vast territory when it comes entirely under Royal Air Force control.

The machine is capable of carrying a load of nearly two tons, and can accommodate 12 persons, with full military equipment, in addition to the pilots, water, and food supplies.

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ELEMENTARY AERONAUTICS and MODEL NOTES

Kite Flying

THE behavior of kites is certainly very puzzling to those who do not thoroughly understand the subject. A kite may be made with the greatest degree of perfection, and placed in the hands of one of considerable experience; nevertheless, it may behave very badly, diving suddenly to the ground without any apparent reason. Then, again, this same kite will sometimes steadily mount in the air until it reaches a height difficult to account for.

If the surface of the earth were perfectly smooth, and the wind should always blow in a horizontal direction, kites would not show these eccentric peculiarities, but as a matter of fact, the air seldom moves in a horizontal direction; it is always influenced by the heat of the surface of the earth.

Heated air is continually ascending in some places only to be cooled and to descend in other places. If one is attempting to fly a kite where the air is moving downwards, he will find it an extremely difficult matter, whereas, if he is fortunate enough to strike a current of air which is rising, the kite will mount much higher in the air.

Kites sometimes rise upwards and continue moving into the wind until they pass directly over the spot where they are attached to the earth. It is only on rare occasions, however, that a wind is found to be blowing at a sufficiently sharp upward trend to cause a kite to fly at such an angle. As the center of the upward current is constantly moving, it is certain that very soon it will move away from the point from which the kite is being flown.

An example of the force of rising air currents is seen in the following observations made by a noted scientist during the burning of a large warehouse in New York many years ago. The wind was blowing a gale through all the streets leading in the direction of the fire, although it was quite calm everywhere else. The flames mounted straight in the air to an enormous height, taking with them a large amount of burning wood. At a point fully 500 feet from the fire a piece of partly burned 1-inch board 8 inches wide and 4 feet long, fell through the air. This board had evidently been taken up to a great height by the tremendous uprush of air caused by the hot fire. It is very evident that a kite made of boiler iron could have been successfully flown under these conditions, providing that it could have been brought into the right position.

Model Photographs Wanted

AERIAL AGE wishes to obtain a photograph of the Orenco Fighter model, plans of which were published in the March 14, 1921, issue. Anyone having built a model from these plans, who will send in a clear photograph of it that can be used for publication, will receive in return for it a large sized professional photograph of a well known man-carrying aeroplane.

To the first one sending in a clear photograph of the Curtiss Navy Racer model, described recently, will be sent by return mail a large photograph of the real machine.

Fifteen H. P. Sled Travels 80 Miles an Hour

The motor-propelled ice sled illustrated in the photographs below, is of the latest design by E. J. Andries, 283 East Grand Boulevard, Detroit, Mich. The Andries "Air Sled" was operated for the first time last month on Lake St. Clair. The great interest in this sport is shown by the increasing number of air sleds which have made their appearance on the lake in the past two years.

The body, patterned after the conventional aeroplane fuselage, is made entirely of wood, fibre and aluminum, screwed and bolted to five bulkheads. Steering is accomplished entirely by means of an air rudder, balanced above a short vertical fin and operated by a foot-bar.

A tail skid is provided which comes into play only when excessively rough spots are encountered. The body is fourteen feet in length and weighs 250 pounds. An instrument board carries all motor controls.

Although it is powered only with a 12 to 15 horsepower motor, it is capable of a speed of eighty miles an hour.

Racing Auto Makes High Speed

As far as American aeroplane speed records go, automobiles have the lead on aeroplanes, in one-mile stretches at least. The world's speed record for automobiles has been smashed by Sig Haugdahl, a Norwegian driver, early in April of this year. He negotiated a mile at Daytona Beach, Florida, in 19.97 seconds, slipping 3.1 seconds from the previous record, held by Tommy Milton. Haugdahl's performance gives him a rate of 180.27 miles an hour, which is over 3 miles an hour faster than the Curtiss Navy Racer. It must be remembered, however, that the Navy Racer at times travelled at a much greater speed than this, and that the speed of 177 miles is the average for the entire circuit during the Pulitzer Trophy Race.

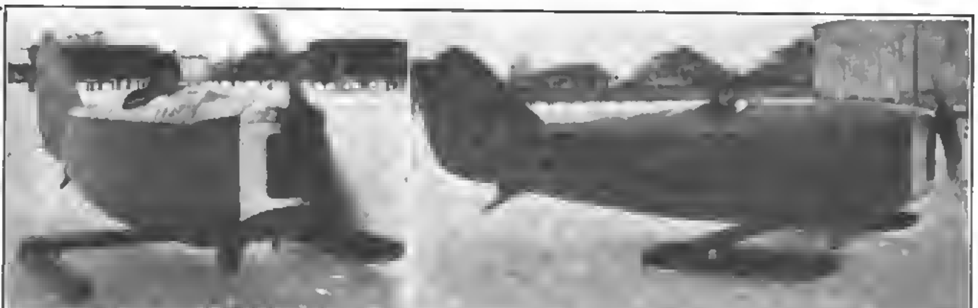
Exhibition Model Built by Aerial Age Reader

Several stores in Toledo have displayed the 30-inch exhibition model designed and built by Wilbur J. McKenna, of 115 E. Woodruff Avenue, Toledo, Ohio. Although it was his first attempt at anything of this kind, the model is a very neat piece of work, and attracts many people to view it in the store windows.

The outline does not follow any particular design, but all the conventional parts are arranged as on the average aeroplane. It is equipped with a small 110-volt electric fan motor which drives a propellor 6 inches in diameter. The fuselage is covered with metal over an orange wood framework. Struts are made of copper tubing. Wings are solid wood. The landing gear is provided with rubber-tired disk wheels.

A full set of controls is installed in the cockpit. There are also electric lights and two-speed control lever which regulates the speed of motor.

A 15 H.P. motorcycle engine drives the Andries Air Sled 80 miles an hour



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RADIO DIGEST

Flying Parson's Plane Broadcasts Concert

A radio concert several thousand feet above the earth was broadcasted April 14 as an aeroplane piloted by Lieut. B. W. Maynard, the "flying parson," flew over New York City. The stunt was for the benefit of the fund for a veterans' mountain camp in the Adirondacks, of which Lieut. Maynard is campaign director.

The second flight of the plane was made at 3 o'clock on Sunday, April 16, when Lieut. Maynard preached a sermon from the clouds.

Radio Expert Addresses Aeronautic Executives

One of the largest groups of Aeronautic Executives attended their sixth semi-monthly luncheon at the Café Boulevard, Friday, April 7th.

The speaker, Mr. Jack Binns, Radio Editor of the New York Tribune and the Popular Science Monthly, was introduced to those present by Chairman R. R. Blythe, who in his introduction stated that Mr. Binns, besides being known all over the world as the hero of the sinking of the S. S. Republic, was perhaps one of the best informed men of the use of wireless and radio for aircraft.

Mr. Binns is opening his address pointed out the necessity of equipping all passenger carrying aircraft, operating between two cities, with radio.

"I was asked the other day," he said, "why it was that commercial aviation could not develop overnight, as had radio. My questioner evidently did not know that radio experiments and developments have been going on for the past twenty years and this so-called radio craze is nothing more or less than the result of these years of pioneering effort. Radio on aircraft can serve two purposes. First, it will allow pilots by means of directional instruments to keep on their course, and make a safe landing through fog and heavy weather. Secondly, it will permit communication from the land telephone, via radio, to passengers on aircraft in flight."

Mr. Binns referred to the loss of the independently owned flying boat "Miss Miami" with its toll of five deaths. It was his opinion that these lives could have been saved if a radio set had been on the ship.

In closing, Mr. Binns urged that operators of commercial aircraft particularly the larger companies, should without delay equip each of their planes with radio apparatus. Even if the initial cost was high, one accident would prove the wisdom of such installation.

At the close of the luncheon Mr. Blythe read the text of a resolution calling on the Contest Committee of the Aero Club of America to settle the controversy in regard to the award of the Larsen Trophy, which arose at the Omaha Air Meet last fall. This resolution was signed by all the Aeronautic Executives present, which completed a representation from every reputable aircraft company in the east.

New Amplifier Gives Quality with Volume

Amplification of voice waves, giving the original true quality, increased many thousandfold in volume without a corresponding increase in the distortion caused by reproductions, is the latest progressive step in the development of wireless telephony.

This has just recently been accomplished by the use of the newly marketed two-stage amplifier and loud speaking receiver of the Western Electric Company. Leading New York dealers in radio apparatus witnessed the first demonstration of the device recently.

The machine proved its worth beyond the highest expectations of the engineers.

Harry Goldman, of the Aldan Accessory Company, was among the first to appreciate the possibilities of the perfected device, and immediately asked for the first supply to be given distributors.

Explaining the two-stage amplifier and loud speaker, the details of which he made public for the first time, Mr. Goldman said:

"The new Western Electric two-stage amplifier is a masterpiece. It is a two-stage amplifier, three-tube, with two tubes used in the last stage, the last two tubes controlled by "push-pull" switch. The first bulb is also an amplifying tube.

It succeeds where other amplifiers and loud speakers fail, in that it amplifies ordinary speech and voice currents, keeping their exact tone and quality even when increased 200,000 times, without the usual added distortion.

"To explain it in lay language, if a solo by Galli-Curci is being transmitted, her voice, though increased in volume thousands of times, retains the distinctive characteristics of her particular voice. Whereas ordinarily it would come in as some high soprano, hardly distinguishable from that of any other concert star, the Western Electric amplifier and loud speaker receives it so that it is distinguishably Galli-Curci's voice.

"Here is another way of putting it. When a man speaks in an ordinary conversational tone, his voice is distinctive and natural, yet when he shouts it increases in volume but loses its quality, often cracks. The Western Electric two-stage amplifier, on the other hand, takes the ordinary voice, magnifies it, expands it to what would relatively be a gigantic shout, yet does not 'flatten' it or destroy its tone values.

"Heretofore every effort to do this has resulted in increased distortion.

"The instrument is the same which was used at Madison Square Garden in receiving President Harding's address, and two years ago, when the company's engineers were experimenting with it, Cornell men, speaking into an ordinary telephone receiver, connected with the amplifier placed on the roof of the West street building, spoke to the Aquitania sailing down the bay with the Cornell cross-country team aboard. The Acquitania answered with radio.

"I really believe that it is one of the greatest practical advancements which have been made in the science, as it has already proved its worth and adaptability to ordinary commercial usage."

Easy for Novice to Hear Broadcasts

To the novice, trembling on the verge of entry into the radio world, the aerial is the most formidable of the obstacles to be surmounted before the sweet strains of W J Z enter his ears by way of his own set.

The greatness of the difficulties which he must overcome depends upon many and varied things. If he is an apartment dweller, the temperament of his landlord, the shape and height of the roof, and the nearness of power lines or telephone wires all enter into the matter. If he is a suburhanite, the length of his backyard, the nearness of big trees, and the need for a tower or some other support, preferably higher than the house end of his antenna, all enter into the matter.

The radio amateur who desires only to listen to the broadcasts sent out by Newark, Pittsburgh, Springfield or Medford Hillside, need not lose too much sleep and hair over his problem, for all he needs is a single stand of wire, preferably between 175 and 200 feet long, of copper, phosphor-bronze, or aluminum, slung at from thirty to fifty feet above the earth.

A somewhat more elaborate antenna is needed by the novice who hopes some time to go into the sending end of the game, but these are not so terrifically difficult as they may seem after listening to the chatter of expert amateurs.

Three types of antenna, the inverted L, the T and the umbrella, which are sufficiently efficient for the work contemplated.

The first of these, much used on ships, is called the inverted L, because the lead-in from the four strands composing it is from one end, giving the appearance of an L with its toe pointing earthward. If you desire to receive one station particularly well—Newark, for example—the aerial should point in that direction, with the lead-in to the apparatus indoors from the nearest end of the station. This type is particularly effective in receiving long wave stations. The length of the aerial should not exceed 100 feet, as in sending a longer aerial would give a natural wave length above the 200 meters at present permitted to amateurs.

The second type, the T, is much like the inverted L, for it consists of four wires suspended in the same plane. The lead-in to the set in the case of the T, however, is directly in the center of the span. The amateur must take care to get the precise center if he hopes to secure the maximum efficiency of his aerial.

The T type should not be longer than 135 feet, and neither of these aerials, if used for transmitting, should be higher than thirty-five feet. Otherwise the natural wave length will exceed the present 200 meters permitted. In the use of this aerial the amateur will discover that the waves come in strongest from stations which are in line with the length of the antenna.

The third type of aerial, the umbrella, is more or less of a makeshift, designed for use where the spanning space is not sufficient for either the inverted L or T aerial. This type receives or transmits

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waves equally well in all directions, but is not a very good radiator in any direction. It consists of a pole or mast, from which four wires stretch downward and outward. The lead in this case is from the upper end of these wires, which are, of course, carefully insulated from both the pole and the stakes at the foot, holding the antenna wires.

There is nothing particularly mysterious about the aerial or its insulation. The object of the aerial is to intercept feeble radio waves. These waves induce in it a current of feeble voltage, but of high frequency oscillation. Naturally this wire should be a good conductor and should be insulated from its supports, so that the whole energy of the current may be led to the receiving apparatus which is to translate it into sound, slight or great, according to the apparatus. Greater care in insulation should be taken if the aerial is to be used for transmission.

The insulators may be purchased, if other amateurs have not already cleaned out the nearby stores, or ordinary electric light wire porcelain cleats may be used. The lead-in must also be carefully insulated and should be kept clear of all obstructions.

The lead-in should be brought down to a knife blade switch which may direct the current either to the set or through an outdoor connection to the ground. This switch should be thrown to send the current on the latter path when not in use or during thunderstorms. The radio instruments inside the house should be connected permanently to a ground, preferably to a water pipe, by ground clamps. A radiator or a gas pipe may also be used as a ground. —N. Y. Herald.

The Brooklyn Show

Several interesting contests that will appeal strongly to amateur fans are being planned for the first annual radio and electrical exhibition of the Electrical Contractors Association of Brooklyn and Queens to be held in the Brooklyn Ice Palace, starting May 6 and lasting two weeks.

One will be a contest for the Brooklyn Council of the Boy Scouts of America. The Boy Scouts are exceptionally enthusiastic radio fans, so the contest is sure to create unusual interest. In all probability prizes will be offered for the best receiving set constructed by a Boy Scout. Also another prize for the smallest set exhibited.

The Crocker-Wheeler Co., of Ampere, N. J., has given the Brooklyn Contractors a motor generator for the operation and transmission. These are the motors used by the United States Government on its aircraft and ships. The motor will be seen working at the show and at the end of the exhibition, it will be awarded as a prize in another amateur competition.

There is being built on the roof of the Ice Palace, located at the corner of Atlantic and Bedford Avenues, a 2,400 foot antenna. It will be the longest in the city. The antenna will be used for receiving and sending messages during the exhibition.

It is planned to have Mayor Hylan open the show. He will do it by radio either sending his opening message from the exhibition or sending it from a broadcasting station so that it may be picked up and heard by all at the opening of the show.

Uses for Radio Outside of Entertainment Are Cropping Up Steadily

Aside from the entertainment features of radio, many new uses are being found for this comparatively new development. Recently, persons on the streets of one of our large cities were astounded to see an automobile unoccupied, and apparently undirected, proceeding under its own power through the traffic, uncannily stopping, starting, turning out, honking its horn, and acting precisely as if guided by an invisible driver. And so it was, the real driver being in another car some distance away and directing it by wireless.

The same application can be made to boats and to airplanes, and progressive fire chiefs are experimenting to determine the possibilities of controlling fire-fighting apparatus by some similar method which will lessen the danger to firemen, and make it possible to place the fire apparatus closer to the vulnerable points in the conflagration.

Among those endeavoring to find wider uses for wireless are Assistant Fire Chief James E. Granger of Cleveland, Ohio; Chief Moran of the Hartford (Conn.) Fire Department, and Superintendent Garrett of the fire-alarm signal department of Dallas, Texas.

Superintendent Garrett has a radio receiving set installed in his automobile, and by this means is kept informed of every fire alarm, no matter where he may be at the time.

During the recent primary election in Pittsburgh the principal candidates gave short addresses over the radiophone, this being the first instance of its use for such a purpose.

When Gypsy Smith, the great evangelist, was holding a series of meetings in conjunction with the forty-eight Pittsburgh churches, these services were broadcasted over the radiophone by K. D. K. A. An enterprising publicity man installed a radiophone in the Gypsy's apartments at the Schenley Hotel, and surprised him with the phonographic production of his own voice from the radio station, seven miles distant, and also the singing of his own choir of over a thousand voices from the Motor Square Garden, two miles away.

Radio Corporation Offers Statement on Supply Situation

The question of radio supplies agitates a great many people at present, since so many of the radio enthusiasts often find it impossible to satisfy their simplest needs. The cause is, of course, the totally unexpected size of the demand for such equipment and the inadequate preparation for supplying it under which the manufacturers all labor. The following official statement by the Radio Corporation of America is of timely interest, implying as it does that that company and its associates are in the midst of a manufacturing programme which will not cease until the necessary apparatus is readily available. The statement is signed by E. E. Bucher, sales manager of the corporation:

"The Radio Corporation of America is endeavoring in every way possible to meet the unprecedented demand for radio devices, including vacuum tubes, broadcasting receivers, and other equipment, which has recently met with much response, not only on the part of the amateur and experimenter, but also on the part of a great many people who are interested to equip their homes with suitable radio telephone devices for receiving music, concerts, lectures, and other interesting features transmitted from radio telephone broadcasting stations.

"The factories of the General Electric Company and of the Westinghouse Electric and Manufacturing Company, which are manufacturing such devices for the Radio Corporation of America, are now operating on a greatly expanded production programme, and it is expected that within the next few weeks considerable quantities of material will be shipped to us on orders already placed with the factories by the Radio Corporation. These will be delivered to our customers as rapidly as received in the warehouse.

"Distributors are requested to communicate the above information to dealers, and to inform them that orders will be filled by us just as promptly as possible. This applies to all classes of radio apparatus for which we are accepting orders, including radiotrons, vacuum tubes, etc., which are employed for reception.

We believe that radio broadcasting is here to stay. The great opportunities for the sale of radio devices can, in our judgment, only be properly taken advantage of if all those who are interested in distributing and selling this apparatus properly equip themselves to handle this class of merchandise in a satisfactory way. This means that the dealer, or whoever is effecting the sale to the consumer, must familiarize himself with the product, explain its capabilities as well as its limitations, and lend assistance in every way toward the proper installation and maintenance of radio sets.

"Those who desire radio equipment and cannot for the moment obtain it, should be informed that the present shortage is but temporary, and due entirely to the great demand which suddenly came as a result of broadcasting, and that the Radio Corporation and its associates, the General Electric Company and the Westinghouse Electric and Manufacturing Company, are doing everything in their power to produce the necessary apparatus with maximum speed; that normal production is expected to begin within the next few weeks, and that deliveries will then be promptly made.

"A new catalogue covering all of the radio devices being manufactured for the Radio Corporation of America by the General Electric Company and the Westinghouse Electric and Manufacturing Company is now in course of preparation, and it is expected that it will be available for distribution within thirty to forty days from date. This catalogue will contain information of value to the wholesale distributor, the retail dealer, and the ultimate user of radio apparatus.

"We solicit your co-operation, and at the same time ask your indulgence until we have obtained factory production which will enable us to meet the demand."

Radio on Mail Planes

One of the big air mail ships came over from Chicago to Washington April 15 in the flying time of 6 hours and 2 minutes, piloted by E. Hamilton Lee. The mileage was 715 miles, which averaged 119 miles per hour. This ship came here for the purpose of having installed as a part of its equipment the radio sending and receiving telephones. This is the first of the transcontinental ships to be equipped with this wireless telephone-outfit. It is expected to equip all of the air mail ships with these instruments. The radius is 200 miles. With this wireless telephone equipment attached to the airships the pilot will be in constant touch with the station just left and the one to which he is flying. There will also be a range finder to locate the station toward which he is flying during foggy and stormy weather.

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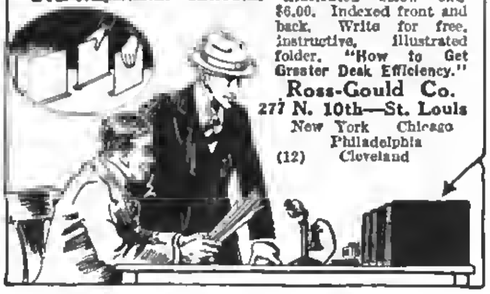

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Age .... Occupation ....

These Models of the

Ruggles Orientator

were manufactured by the U. S. Government under the supervision of the inventor. Duplicates—with improvements—will now be manufactured for civilian aviation schools, also 2 passenger models for amusement park purposes.

Foreign and Domestic Patents Allowed and Pending

Ruggles Orientator Corporation
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NEW THREE SEATER
M. F. Flying Boats
150 Horse Power Motor; full flying instructions. Delivery at Chicago
$2250
James Levy Aircraft Co., Chicago
2035 Indiana Ave.

(*Continued from page* 147)

to France in commercial air transport, but the English service is limited to regular daily trips between London and Paris. Other journeys are arranged according to demand.

The British commercial air subsidy for 1922 is £200,000, or about $900,000, half of it to be used for new planes available to operating companies on a hire basis. Dutch, Belgian and German commercial air schedules dovetail into those of French and British companies, making a fairly complete network over the whole continent with the exception of Russia and points in the extreme southeast of Europe.

From London to Paris by rail and boat the fare is $18.93 and the traveling time 6 hours and 30 minutes. The trip by air costs $30.66 and the traveling time is 1 hour and 45 minutes. For a trifle more than one and one-half times the railway fare the trip can be made by air at a saving of four hours and forty-five minutes in time.

In other instances air travel is more expensive. The trip from Nimes to Nice, in southern France, costs $30, which is at the rate of just about three times the mile charge from Paris to London.

Notwithstanding this regulation of air tariffs, according to the exigencies of competition rather than the value of service rendered, air transport in Europe is being developed for the most part on strictly sound principles. Just enough Government encouragment is given to keep the spark of ambition from being smothered under unavoidable financial losses due to the hazards of this new common carrier enterprise.

—*Editorial in N. Y. Herald.*

(*Continued from page* 158)

in air since the model was placed upside down, thus reversing the buoyancy.

APPENDIX

Strength of Crow's Foot

A test was made to determine the strength of a crow's foot such as is used to fasten the ropes on airships and furnished by the Goodyear Rubber Company. The arrangement on the apparatus was as shown in Fig. 2. The small ropes of the crow's foot were fastened to the floor by means of a rope, and the fabric pulled upward by means of a chain hoist. Suspension scales between the crow's foot and the hoist were used to determine the force exerted. The apparatus was tried without the wood frame work about the iron pipe at first, and it was noticed that the middle fingers were taking by far the greater part of the load due to the bending of the pipe. In order that all four fingers might be stressed to more nearly the same degree the wood frame was made so that it supported the pipe at all points, and with a piece about 1¾ inches by 2½ inches across the back, as shown in the rear view to prevent the ends being bent toward each other. However, even with this arrangement, it was noted that the two middle fingers were under greater stress than the others.

Failure occurred at 1125 pounds which gives, when the weight of the frame is subtracted, practically 1100 pounds. The fibers of the rope held securely, and it was only the fabric at the ends of these fibers which gave way.

Tests to determine the strength of small crow's feet (about 3 inches $\times$ 3½ inches) were also made. These were cemented to the fabric of the large crow's foot, and weights applied until failure occured. Seven tests were made and failure occured at the following loads:

No. of Test	1	2	3	4	5	6	7
Load (in lbs.)...........	190	190	185	185	200	180	180

Average load = 187 pounds.

The time taken on each test, except No. 7, was about 10 minutes. In No. 7, a load of 160 pounds was put on and left for about 20 minutes, in order to ascertain roughly if time was an important factor. In this test practically all the strands of the cords pulled out, whereas in all the other tests, except No. 6, only part of them pulled out while the others broke, the number which broke varying from 1 to 3.

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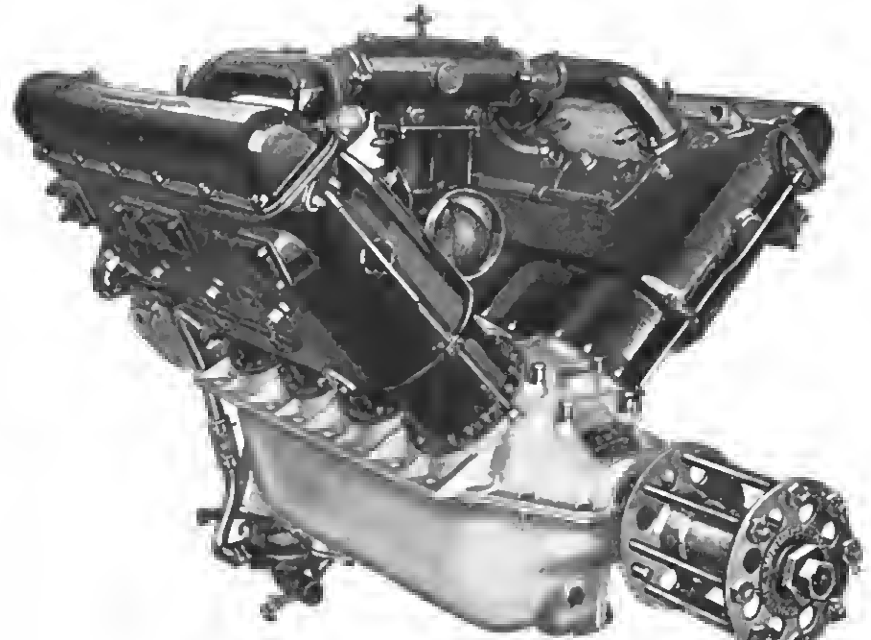
Dealers wanted

DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Nebraska Aircraft Corporation
Lincoln, Nebraska



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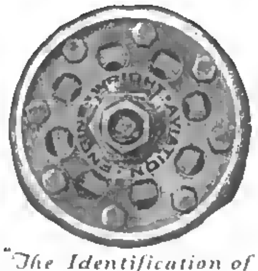

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AERIAL AGE WEEKLY

VOL. 15, No. 8 MAY 1, 1922 10 CENTS A COPY

Including Radio Section

Airscape of Modesta, California, from an altitude of 500 Feet ©P. S. Daniells

Commercial Flying Becoming Safer—Seaplane Landing Places Along the Atlantic Coast—Communications and Beacons on Air Routes

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May 1, 1922 AERIAL AGE WEEKLY Vol. XV, No. 8

TABLE OF CONTENTS

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DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

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With which Flying *is consolidated*

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Commercial Flying Becoming Safer

RECENT accidents in the air may damage commercial aviation unless the public realizes that most of these are the result of the more dangerous military flying or of the use of obsolete aircraft which should be banished from the air by legislation, Grover C. Loening, president of the Aeronautical Chamber of Commerce, said recently.

Mr. Loening pointed out that commercial machines operated by reliable companies are equipped with a new type of wing section that does not stall in the air. None of the machines in recent crashes were equipped with these.

"While these new types of wing sections are not so applicable to military machines because they reduce the quickness of maneuvering and make a tail spin difficult, nevertheless they are essential on a safe commercial machine because a stall, instead of becoming a dangerous feature, results merely in the plane's settling on a level keel without losing its controlling power," he said.

Mr. Loening pointed out that there are countless rules and regulations for ships and mariners, but as yet practically none for planes and airmen.

"The progress already made in Congress in connection with the Wadsworth bill for a bureau of civil aeronautics in the Department of Commerce shows that there is already a general appreciation of another large group of causes of aviation accidents that can be eliminated. That is the flying on dangerously weakened and old, unfit aircraft, and also by operators of aircraft who are unlicensed or otherwise unsuited to perform the expert and professional duties of an air mariner. Regulation of commercial aviation by law is one of the greatest needs of commercial aviation today. The advantage of such regulation is brought out by the very small number of accidents during the year occurring in Canada, where operators and aircraft are inspected and licensed."

As examples of the safety of commercial aviation properly controlled Mr. Loening pointed to the air mail service, which has been operating daily from coast to coast without an accident in the last forty weeks, and the Aeromarine Airways, which has carried thousands of passengers in safety.

New Use for Planes

AEROPLANES have been used for fighting, bombing, racing, freight carrying, mail carrying, controlling forest fires, gasing caterpillars and other insects, hunting seal herds, locating schools of fish, mapping unknown country, photographing impenetrable swamps and doing hundreds of other jobs, but now they are to be used to track the spread of that most destructive parasite, black stem rust, which destroys one or two hundred thousand bushels of wheat yearly on this continent.

The theory of the Department of Agriculture is that the spores of the black stem rust are carried north to the wheat belt in currents of the upper air. Dr. Stakman of the bureau of plant industry of the Department of Agriculture, in cooperation with officers of the engineering division of the Air Service at McCook Field, is designing spore traps to test this theory. Aeroplanes will carry these traps to great heights, and on opening them at previously determined altitudes will be able to collect the spores carried in the air at various heights and in various wind currents. Once the spore's means of travel and point of origin is determined it can probably be eradicated.

Science and Fire Fighting

THE picture Chief Kenlon recently drew of the Fire Department of the future is all the more interesting because it is so likely to become reality soon. John Kenlon is no visionary, after thirty-five years of the fire fighting game, and when he sees fire engines on the roofs of buildings, helicopters dropping gas bombs on blazes and fire alarms sent by radio it is reasonable to predict that New York will see these improvements, at least in the downtown district, within twenty years.

The war showed, although in a horrible way, the utility and power of gases and chemical liquids. The ingenuity that was employed in destroying life should easily be turned to the more laudable purpose of saving property. If the sprinkler pipes in business buildings should be emptied of water and refilled with some gas which would extinguish fire without damaging floor or goods the saving would be great.

The firemen of the next generation may make his heroic rescues not from a swaying ladder but from a purring aeroplane.—Editorial in *N. Y. Herald*.

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THE NEWS OF THE WEEK

National Advisory Committee for Aeronautics Meets

Washington.—A complete and detailed study of the plans and specifications of the Navy's giant Airship ZR-1 was requested of the National Advisory Committee for Aeronautics at its session April 20 by Rear Admiral Wm. A. Moffett, Chief of the Naval Bureau of Aeronautics. Before the rigid airship, whose parts are now being fabricated, but which had not yet been assembled, is completed, Admiral Moffett is desirous of having a thorough study made of all the stresses and strains it is likely to encounter in the air under service conditions and it is for this reason that he has asked the Committee to appoint a special technical subcommittee of aeronautical experts and engineers to make a special study of its design and structure. While the Navy is confident that its own plans for the airship are correct, it is nevertheless desirous of securing the opinion of an independent committee of experts to avoid the possibility of future adverse criticism. The whole committee approved Admiral Moffett's request and authorized its Chairman, Dr. Walcott to appoint a special technical subcommittee for this purpose.

The session of the National Advisory Committee today was the first meeting of the year of this group of twelve government and civilian experts on aeronautics and kindred subjects, operating as an independent government establishment reporting directly to the President, and co-operating with the Government Departments interested in aeronautical development.

Dr. J. S. Ames, Chairman of the Executive Committee, reported on the progress made at the Committee's research laboratory at Langley Field in the development of a new heavy-oil, fuel-injection aircraft engine for the Bureau of Aeronautics, Navy Department. While the details of the development are still held confidential, it is known that its use will greatly reduce the fuel fire hazard in aircraft, which has been largely responsible for the loss of life in recent aircraft accidents. A large percentage of aeroplane fatalities are due to gasoline fire following the crash. This new engine not only does away with the use of gasoline, but also operates without carburetor and spark plugs, thus eliminating certain causes of trouble.

Drawings and performance characteristics of a new high-speed aeroplane wing, just developed at the Committee's laboratory, Dr. Ames stated, have been turned over to the Army Air Service for use in the design of a new high-speed pursuit type aeroplane. This new wing is a thick wing section with space for internally bracing the wing and eliminating any wires or struts in the design of the aeroplane. The wing is both tapered in section and in plan form, conforming somewhat to the general shape of a bird's wing, that is, tapering toward the tip, both of which add materially to the speed charcteristics of the wing.

Dr. Ames also explained the operation and application of three new recording instruments recently developed at the Committee's laboratory for studying the performance not only of the aeroplane itself in flight, but the actual conduct of the operator. The instruments are a new type of recording accelerometer, and instrument for recording the positions of the aileron, rudder and elevator in maneuvering the aeroplane. The use of these instruments, together with a recording air speed indicator, gives a complete history of the loads induced in an aeroplane when maneuvering or landing, together with the range of operation of the aeroplane controls. The information obtained is not only of great value to the designer but also will be very helpful in instructing pilots in the proper use of the controls when carrying out maneuvers.

The meeting was presided over by Dr. Charles D. Walcott, Chairman of the National Advisory Committee for Aeronautics, and Secretary of the Smithsonian Institution. Mr. Paul Henderson, the newly appointed Second Assistant Postmaster General, in charge of the Air Mail Service, was present on invitation. The other members of the Committee present were:

Dr. Joseph S. Ames, Chairman Executive Committee; Dr. S. W. Stratton, Secretary; and Director, Bureau of Standards; Major General Mason M. Patrick, Chief of Army Air Service; Rear Admiral William A. Moffett, Chief of Naval Bureau of Aeronautics; Rear Admiral D. W. Taylor, Chief Constructor, U. S. Navy; Professor Charles F. Marvin, Chief of the Weather Bureau; Dr. John F. Hayford, Northwestern University, Evanston, Ill.; Major Thurman H. Bane, Chief of Engineering Division, Army Air Service, Dayton, Ohio; Dr. Michael I. Pupin, Columbia University, New York City; Mr. Orville Wright, Dayton, Ohio.

Mr. Orville Wright and Mr. G. W. Lewis, Executive Officer of the Committee, leave Washington tonight for Langley Field, Va., where they will make an inspection of the Committee's laboratory and the research work in progress.

Woman Flies 400 Miles to Do Spring Shopping

Chicago.—Mrs. C. E. Tuttle, of Red Oak, Iowa, came to Chicago April 20 by aeroplane to do her spring shopping. She arrived with her shopping list and an overnight bag after piloting her plane over the 400-mile route from Red Oak to this city in four hours and fifty-five minutes. A mechanician accompanied Mrs. Tuttle.

Mrs. Tuttle is the wife of a business man in Red Oak.

New Round-World Flight by British

London.—Plans are well advanced, says the London correspondent of the Yorkshire Post, for another British round-the-world flight but the date of the start has not been fixed.

All preparations have been made by a flying man of much experience and he will pilot the machine. At present he holds a civilian appointment at the Air Ministry and has been given all possible official aid.

A specially designed flying boat of huge dimensions is to be used. The crossing of the Atlantic will be the first stage, starting from Lisbon and taking in the Azores.

The Late Sir Ross Smith

London—Sir Ross Macpherson Smith, on the eve of his orojected flight around the world, was killed in the presence of his brother, Sir Keith Smith, at Brooklands, April 13, while he was testing the Vickers-Viking machine in which he had planned to make the world circuit. Sergt. J. M. Bennett, M. S. M., the mechanician, who accompanied him on his famous flight to Australia in 1919, was also killed in the crash.

For half an hour before taking up the machine himself, Sir Ross had been in the machine while Capt. Cockerell, of Vickers, Ltd., put her through her paces, during which the Viking behaved beautifully. On descending, Capt. Cockerell handed over the machine to Sir Ross, who, amid shouts of applause from the spectators, made a fine take-off. His brother, Sir Keith, was delayed in reaching Brooklands and so was unable to accompany the intrepid flyer.

For fifteen minutes Sir Ross put the machine through the ordinary flying test. Then he prepared to descend. When about 1,200 feet from the ground he shut off the engine. Almost immediately she began a nose dive, and as the efforts of her pilot to right her failed, she made a spinning nose dive.

Gathering terrific speed as she neared the ground, she smashed to pieces on the fence surrounding the Brooklands automobile race track. Sir Ross was lifeless when lifted from his seat, and Sergt. Bennett, sitting beside him, died a few minutes after being extricated.

No other flight had ever been so carefully thought out. Months ago all the proposed landing fields over most of the 21,000-mile trip had been closely inspected. All the gasoline depots had been planned. It was to have been the crowning achievement of his flying career and Sir Ross had every confidence that he would succeed.

The Viking's gasoline capacity was 385 gallons, giving an estimated range of more than 1,700 miles. It was fitted up with a motion picture camera and sending, receiving and directional wireless apparatus. There were to have been fifty pounds of engine spare parts aboard, and Sir Ross and his companions were to have limited their personal apparel to eight pounds each. Two revolvers, a Winchester rifle and some fishing tackle were to have been carried.

R. K. Pierson was the designer of the Viking. He also designed the machine in which the flight was made to Africa in 1920, the Vickers-Vimy, in which the late Sir John Alcock and Sir Arthur Whitten Brown flew across the Atlantic, and also the machine in which Sir Ross Smith made his 11,294-mile flight to Australia in a little less than twenty-eight days. It was the latter achievement which induced King George to confer knighthood upon the two Smith brothers.

Personal Par

Roger Q. Williams, pilot, plane changer and aerial acrobat, who has been identified with aviation for a number of years, announces that he has given up exhibition work and is using his planes to aid The Jensen Specialty Corporation, of Los Angeles, Cal., in marketing their products. Friends will recall his work with the following circuses: World's Famous Trio, Tinney Fearless Flyers, Sammie Harrell Flying Circus, Sikeston Aerial Corporation, and the Roger Q. Williams Famous Flyers.

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The AIRCRAFT TRADE REVIEW

Curtiss Aero Profits

The Curtiss Aeroplane and Motor Corporation for 1921 reports gross profits on sales of $578,118, and net profits, after all selling expenses and subsidiary company losses, of $277,466. After allowing for interest charges depreciation, etc., there was a net surplus for the year of $101,207. The balance sheet at the close of the year showed a profit and loss deficit of $1,158,924.

C. M. Keyes, President, in remarks to stockholders said that on Dec. 31, 1921, the company had Government contracts on hand amounting to $1,763,224, "which is sufficient to operate the factory at Garden City and part of the factory at Buffalo. A large percentage of the factory at Buffalo is leased to other manufacturers on a floor space basis."

A. C. C. Joins U. S. C. C.

We are pleased to advise you that the Aeronautical Chamber of Commerce of America has been admitted as a member of the Chamber of Commerce of the United States, the national organization which includes some 1200 or 1500 commercial and civic organizations throughout the United States.

Palm Beach-New York Rapid Flight

Flying at an average speed of 130 miles an hour through three storms, a Loening Air Yacht, carrying a total load of 1,600 pounds, made the flight from Palm Beach, Fla., to New York, a distance of 1,210 miles, in nine hours and fifty-six minutes. Railroad time between the two points is forty-eight hours.

One stop was made, at Southport, N. C. The flyers took off at Southport landing at the Columbia Yacht Club, in the North River, New York City. Clifford L. Webster, former United States Marine Corps aviator, piloted the seaplane, and claimed to have established a time record. Fred R. Golder, of Port Washington, L. I., mechanician, accompanied him.

Webster's machine is the altitude record holder for seaplanes, having taken four passengers a height of 19,500 feet at Fort Washington on August 16, 1921.

Webster said that on several occasions he was compelled to fly as low as twenty feet above the surf to escape dense fogs. Clouds and fog, he said, compelled him to guide his course across Pimlico Sound, North Carolina, and Chesapeake and Delaware bays by compass. The average height at which he flew, the pilot said, was 1,800 feet.

The air yacht in this record flight is of the type recently purchased by Vincent Astor, who has retained Webster as his pilot. Webster was Mrs. Astor's flight instructor at Bay Shore before the war.

Grover Loening, designer and builder of the air yacht, said that he did not regard the flight as indicating that ten-hour trips between Riverside Park and Palm Beach would be common incidents for a year or two yet. But it did indicate, he said, that this particular kind of flying was the safest that could be undertaken.

Learn to Fly

The Dayton-Wright Company, of Dayton, Ohio, have just gotten out a little booklet, "Learn to Fly," which should be in the hands of everyone contemplating a flying course. The Dayton-Wright "Chummy," which is used exclusively in the school, is properly illustrated.

Baltimore to Hold Air Meet

Every year since the close of the war the Baltimore Flying Club has held an aviation meet or, as it is now called, an Exhibition of Aircraft. Each year's meet so far has proven to be a bigger success than the last. In 1919 there were hardly a half dozen ships on the field; in 1920 there were twelve or fourteen and the meet lasted an entire week. This, however, did not prove satisfactory for in 1921 the Club went back to the single day meet and drew the largest crowd they had up to that time, while the exhibiting ships numbered about twenty-five including commercial planes, sport planes, Army planes and National Guard planes.

A departure is to be made this year in having an event for water ships, that is, seaplanes and flying boats. This is easily possible for Logan Field, as the Club's beautiful and well kept airdrome is within a few hundred yards of the Patapsco River, a wide and well protected landing harbor.

The principal event, however, will be for land planes and the contests will be divided into four classes e. g. (1) for commercial planes designated as ships carrying useful load of 750 lbs. or more; (2) for sport planes which includes all one, two and three seaters; (3) for service pilots, Army pilots, Navy pilots and Marine Corps pilots and (4) for National Guard pilots.

For the first time prizes will be awarded but they will not be for speed or high altitude but rather for efficient design and precision flying. This does not mean there will be no speed races, for there will be several, but rather that speed will be secondary to speed range.

It is expected that practically all the entrants at the New York show to be held April 30th will remain over for the Baltimore event and a number of additional commercial entries will be received from the middle west.

The Air Service will send ships from Bolling Field, Langley Field and Aberdeen.

Aerial Lighthouse Established at American Airways Base

American Airways, located at College Point, Long Island, announce the establishment of a highpowered searchlight to be maintained as an aid to aviators. The light will be a 14-inch lens Navy type, and will be thrown at an angle of about 50 degrees elevation, pointing due North. The character of the light, whether a flashing or fixed beam has not yet been decided by the Harbor Commissioners of New York. Announcement of their decision will be made in a later issue.

The light will be visible from sunset to midnight every night, as there are always a number of late flyers coming in down the Sound during the summer months. The base of American Airways is always available for itinerant craft, and mooring and watchman service are available, in addition to regular 'aerial garage' service, such as emergency and permanent repairs, overhauls, etc. The base is equipped to do work of whatever character may be required, being completely equipped.

American Airways have recently been made Curtiss representatives and maintain several machines for demonstration and joy-ride purposes.

Experimental work is going forward on a patent contracting wing, and an all metal amphibian scout.

The Trading School for Aeroplane Mechanics is continually getting new students and those who have been here for some length of time are becoming most proficient in their work. Several ships have been rebuilt this spring, and several others sold. A large number of applicants for the Pilot Training Course recently in in response to advertisements in this publication. The response has been most encouraging.

Spokane News

Spokane, Wash.—Six hundred feet of aerial moving picture films of the Columbia Basin project will be taken by the United States Aircraft corporation.

"Under present plans, our big new six-cylinder Spokane motored ship will leave here and will be equipped with the latest Akeley aviation motion picture equipment," Mr. Messer said. "Upon our return here the films will be turned over to the Columbia Basin committee for use in exploiting the work.

"In addition to the moving pictures, we will take 'stills' at different points along the way. This new ship is especially equipped with a large roomy cockpit for picture making. We have a quick-focus camera mounted on a universal table."

According to present plans the ship will go to the Ephrata district and take pictures over the southern part of the district. Later pictures of the remainder of the entire project may be taken.

A Correction

The following letter is self-explanatory: "Thank you very much for putting me on the cover of your April 10th issue. I am sorry, however, that you called it the SPERRY MESSENGER, as it gives the impression that we are responsible for the design of this remarkable little plane. I wish to correct this wrong impression, as you know that the machine was designed by the Engineering Division of the U. S. Air Service at McCook Field, Dayton, Ohio, which is under the splendid guidance of Col. Bane. Mr. A. G. Verville is responsible for the design, and Col. Guy L. Gearhart fathered the proposition and made a great many valuable suggestions."—*Lawrence B. Sperry.*

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NOTES ON LANDING PLACES FOR SEAPLANES ALONG THE ATLANTIC COAST

Prepared by EWING EASTER

For the National Advisory Committee for Aeronautics

New Jersey

Asbury Park.—Emergency landing for small craft only in Deal Lake. Deal is an artificial lake about a mile long and about 150 yards wide. Several bridges and telephone wires make landing and take-off dangerous. Protected anchorage anywhere. Gas and oil available. No aviation supplies. No beach. No tide. No current.

Keyport.—Excellent landing for all seaplanes. Moorings in deep water furnished by Aeromarine Plane and Motor Corporation, who have large factory there. Repairs and supplies available. High test gas and oil at factory. Three to four foot tide. Beaching facilities.

Delaware

New Castle.—Landing for all seaplanes. No protected anchorage. No beach. Swift current around wharves. Gas and oil available. No aviation supplies. Tide 5 to 7 feet.

Maryland

Annapolis.—Excellent landing for all seaplanes. Good sand bottom and beaching facilities at north end of state road bridge. Annapolis one mile from this point. Weather reports available at Naval Academy. Gas and oil available. No aviation supplies. One foot tide. No current.

Baltimore.—Excellent landing for all seaplanes at Hanover Street Bridge, which can be seen from the air as large concrete bridge south of upper Baltimore harbor. Protected anchorage furnished by Easter Airlines, whose shop and office are located in arch of bridge. High test gas and oil. Aviation supplies and repairs available. One foot tide. Beaching facilities. No current. Ten minutes from business district by trolley. Weather reports available.

Cambridge.—Good landing for all seaplanes. Protected anchorage with firm sand bottom in cove west of steamboat landing. Good beach about one mile west of town. High test gas and oil from Red "C" Oil Company. No aviation supplies. Two foot tide. No current.

Chestertown—Good landing for all seaplanes. Partially protected anchorage with mud bottom near bridge. Beach on opposite shore from town. Gas and oil available. No aviation supplies. No tide. Moderate current.

Crisfield.—Good landing for all seaplanes. Protected anchorage in creek west of town, with firm sand bottom. No beaching facilities. Gas and oil at public wharf. No aviation supplies. Two to four foot tide. No current.

Easton.—Good landing for all seaplanes. Large craft will land at mouth of Tread Avon River and taxi to steamboat wharf at Easton Point. (One mile from town.) Gas and oil available by truck from town. No aviation supplies. Tide negligible. Moderate current.

Ocean City.—Excellent landing for all seaplanes in Sinepuxent Bay. Good anchorage with sand bottom near bridge. Good beach. Gas and oil available. Two foot tide. Strong current at bridge and wharves. No aviation supplies. Weather reports at Coast Guard Station.

Oxford.—Good landing for all seaplanes. Good anchorage in firm sand. Beaching facilities. Gas and oil available. No supplies. One to two foot tide. No current.

Salisbury.—One-way landing and take-off for small craft only in Wicomico River. Very narrow and twisting. Landings will be made at point in river two miles southwest of town and taxi up to public wharf. *No landing for large craft.* Anchor-in soft mud bottom. Gas and oil available. No supplies. No beach. No tide. No current.

Cape Charles.—Good landing for all seaplanes. Avoid stakes and keep in steamboat channel when taxiing up to wharf. Protected anchorage with sand and shell bottom in cove near steamboat wharf. Gas and oil stations on docks. Three foot tide. No supplies. No beach. No current.

North Carolina

Beaufort.—See Morehead City as landing facilities are much better there.

Columbia.—Good landing for all seaplanes in Bull Bay which is three miles from town. In taxiing up Suppernong River avoid stakes and keep in channel. One-way landing and take-off for small craft in Suppernong River nearer town. Protected anchorage with soft mud bottom. Gas and oil available. No beach. No supplies. No tide. Moderate current.

Bell Haven.—Good landing for all seaplanes. Anchorage for large craft in front of town. Protected anchorage for small craft in creek in back of town. Gas and oil available to wharf by truck. No tide. No current. No beach. No supplies. *Avoid submerged reef marked by Wreck East of public wharf.*

Edenton.—Good landing for all seaplanes. Protected anchorage with soft mud bottom in creek west of public wharf. Gas and oil available. No beach. Two to three foot wind tide. Moderate current. No supplies.

Elizabeth City.—Good landing for all seaplanes. Protected anchorage in harbor, with mud bottom. Gas and oil available at public wharf. No aviation supplies. No tide. No current. No beach.

Hertford.—Good landing for all seaplanes. Avoid stakes in landing and taxiing. Protected anchorage with firm sand bottom. Gas and oil available by truck. No supplies. No tide. No current. Good beach.

New Bern.—Good landing for all seaplanes. Unprotected anchorage with firm sand and mud bottom. Severe northeast gales frequent between November and April. Gas and oil available at public dock. No supplies. No tide except wind tide. Moderate current. No beach.

Oriental.—Good landing for all seaplanes. Protected anchorage, with firm sand botom. Gas and oil available from garage in town. One to three foot tide. No current. Good beach.

Plymouth.—One-way landing and take-off for small craft only. *Not safe for large craft. Dangerous as river is narrow and bordered with high trees.* (Width of river about 200 feet.) Protected anchorage with soft mud bottom. Gas and oil available. No supplies. No tide. Moderate current. No beach.

Morehead City.—Excellent landing for all seaplanes. Unprotected anchorage in front of city. Gas and oil available at gasoline docks. Weather reports and aviation supplies available from Coast Guard Air Station two miles south of town. Also beaching facilities there. Four to five foot tide. Swift tidal current at wharves.

Southport.—Excellent landing for all seaplanes. Unprotected anchorage, rocky bottom. Gas and oil at wharf. Two foot tide. Beach. No supplies.

Swann Quarter.—Good landing for all seaplanes in Juniper Bay. Seaplanes will beach at entrance of canal one-half mile from town. Protected anchorage with firm sand bottom. Gas and oil supplies not always available. One to two foot tide. No aviation supplies. Good beach. No current.

Washington.—Landings for large craft will be made east of railroad bridge about one mile from city. Landings for small craft can be made in front of city between bridges. In landing here avoid small stakes. Gas and oil for large craft by truck from city, for small craft at gasoline docks. Good anchorage, mud bottom. No tide. No beach. No supplies.

Wrightsville Beach.—Landing for all seaplanes in sound north of bridge. Take-off along sound to north or through inlet to ocean. Numerous sand bars to be avoided. Unprotected anchorage in sound with sand bottom. No gas and oil except by trolley from Wilmington during winter months. Gas and oil available in summer. Trolley service to Wilmington all year. Two to four foot tide. Swift tidal current. Good beach. No aviation supplies. This is the best point of landing for Wilmington as the river at that point is narrow with submerged stumps and exceedingly swift current.

Wilmington.—See above.

South Carolina

Beaufort.—Landing for all seaplanes. At high tide avoid submerged reef and marshland extending about one-quarter mile out from point of land on opposite shore east of town. Moorings available in front of K. of C. wharf. Good anchorage here also with firm sand bottom. Gas and oil station on steamboat wharf. Aviation supplies available and beaching facilities at Marine Air Station, Paris Island. Four to six foot tide. Strong tidal current at wharves.

Charleston is marked on your map so I presume you have full data. Paris Island is also marked on your map.

Georgetown.—Good landing for all seaplanes in Winyah Bay and taxi quarter-mile up creek to town. Anchorage at mouth of creek with firm sand bottom. (Do not anchor in creek in front of town as bottom here is smooth rock.) Gas and oil

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available at wharves. No supplies. Two foot tide. Swift tidal current at wharves. Beach at mouth of creek.

Georgia

Savannah.—One-way landing and take-off for all seaplanes. Unprotected anchorage with mud bottom. Gas and oil available. No aviation supplies. Swift current. No beach. — foot tide.

Fairhope unsuitable for landing.

Darien unsuitable for safe landing.

Brunswick.—Landing for all seaplanes. Protected anchorage in front of abandoned Naval Air Station. Gas and oil available at public wharves. Tide three to four feet. Strong tidal current at wharves. Beach at Air Station. No supplies.

Fernandina.—Good landing for all seaplanes. Unprotected anchorage near mud flats opposite city. Protected anchorage in creek south of city. Severe northeast gales frequent from November to May. Gas and oil at gasoline docks. No supplies. Six to eight foot tide. Swift tidal current at docks. No beach.

Deland.—Landing for small craft only in Lake Breesford which is three miles from town. Protected anchorage anywhere with mud bottom. Gas and oil available at dock. No supplies. No tide. No current. No beach.

Note.—The St. Johns River route is unsafe for any but very small craft south of Lake George, as the river is narrow and very twisting.

Green Cove Springs.—Good landing for all seaplanes. Protected anchorage on either side of steamboat landing. Gas and oil available from garage by truck to wharf. One to two foot tide. No current. No supplies.

Palatka.—Landing and take-off for large craft north of railroad bridge or south of state road bridge. Landing for small craft between bridges for take-off in small bridge taxi through railroad drawbridge and take-off on north of same. Gas and oil available for large seaplanes by truck and for small craft at public wharf. No supplies. No beach. No tide. No current.

St. Augustine.—Excellent landing for all seaplanes north of bridge. Anchorage with mud botom anywhere in front of town. Protected anchorage and beach in creek at north end of town. Gas and oil available at Capo's wharf or from garages. No aviation supplies. Three foot tide. Strong tidal current at wharves. Weather reports from Coast Guard Station.

Sanford.—At head of St. John's River route for small craft Excellent landing. Protected anchorage with firm sand bottom near public wharf. Gas and oil available from garages. No beach. No tide. No current. No supplies.

Note.—I have operated an "F" boat at the points mentioned and this above report is based upon notations made at the time.

Latitude and longitude is not given as I have no means of ascertaining this data at hand.

In giving the rise of tide I have not taken the figures for mean neap tide but have given figures which allow for the maximum rise due to wind conditions, which are of more interest to the seaplane pilot.

SOME PRINCIPLES GOVERNING THE ESTABLISHMENT OF METEOROLOGICAL STATIONS ALONG AIR ROUTES*

By P. AUJAMES

Chief of the Radio Meteorological Service of the Compagnie Franco-Roumaine de Navigation Aérienne

The organization of a meteorological service for an air route involves the solution of two distinct problems:

1. Distribution and grouping of meteorological stations;
2. Communications.

Experience gained in the establishment of two lines, Paris-Warsaw and Constantinople-Bucharest** enables us to establish certain principles, which it may be of interest to note here.

I. Distribution and Grouping of Meteorological Stations

Before touching upon the study of this question, it is well to recall the principles for laying out an air route. When it is proposed, under existing conditions, to cstablish a regular airplane transportation service between two points 1,500 or 2,000 kilometers apart, it is out of the question, for technical and commercial reasons to fly the whole distance without landing.

Therefore the line is divided into sections of 400 to 500 kilometers, terminating in large cities. Aeroplanes traverse these sections in a single flight. Example: Paris-Strassburg-Prague-Warsaw.

Laying Out the Sections.—A section of an airway should not be regarded as a straight line between two cities (which would be a serious mistake), but as a passage-way from 50 to 100 kilometers wide, within which the actual track is determined by experience, that is to say, from a perfect knowledge of conditions in the regions traversed, thus assuring maximum safety by encircling obstacles, flying over the greatest possible number of landing fields, avoiding districts om meteorological disturbances, etc.

In aviation, a straight line is not the shortest distance between two points, for example: Constantinople-Bucharest by Adrianople and Giurgevo. On this route the itinerary followed by the aeroplane changes from day to day and from one part of the day to another.

The duty of the meteorological organization consists in supplying at any moment information enabling:

1. The departure of aeroplanes, when the atmospheric conditions are suitable for flying and landing with safety;
2. The determination of the path to be followed within the strip of territory constituting the section.

Meteorological Organisation.—Granting the above, the meteorological organization of a section comprises:

(a) The division of a section into a certain number of zones. These zones are portions of the territory with uniform climatic conditions. Examples: Champagne, Lorraine, the Bavarian platteau, Thuringia.

This division necessitates a very careful meteorological study. In each of these zones a variable number of meteorological stations will be installed.

(b) Types of zone meteorological stations, three types:

1. Central stations for collecting information and making soundings, and mountain stations;
2. Auxiliary observation stations.
   (a) Along the route.
   (b) For near lateral protection.
3. Stations for distant lateral protection.

Central Stations

These must coincide as much as possible with regular or emergency landing fields. In each section it is necessary to have at least as many stations of this kind (not including mountain stations) as the average number of hours of flight required for traversing the given section. A station of this type is also established on some summit in every mountainous region traversed. Such stations are provided with complete meteorological outfits. Their personnel comprises at least one meteorologist and one assistant. They can, in particular, make soundings with pilot balloons (or captive balloons). It is assumed that the wind direction and velocity are constant throughout the entire zone within which a station is located, as determined by the soundings.

These stations are connected with the auxiliary observation stations by some suitable means of communication.

Auxiliary Observation Stations

These stations should be located, some in quincunx formation relative to the median line of a section and at 40 kilometers from this line, the others (few in number) on the line itself.

It is a common error to wish to increase the number of observation stations on the direct line between two points on the map. This is a result of the error committed in defining the path of an air route and always results in limited information.

These auxiliary stations do not make soundings. Their only duty is to observe cloudiness and visibility. They do not require special apparatus or personnel. It is sufficient to have agents residing in the locality, such as teachers, customs officers, etc.

The aerial navigation companies have decided to maintain a complete system of these stations. Their distribution in quincunx alone enables the utilization of the meteorological information, even two or three hours after the observation. The fundamental difficulty encountered is that of communication. In the usual case of a wind blowing across the section, the lateral stations enable a fairly exact forecast of cloudiness and variations of visibility in the strip of land included in the

* From "Premier Congrès International de la Navigation Aérienne," Vol. I, pp. 115-119, Paris, November, 1921.

** French Aeronautic Mission in the Orieot.

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section, and, consequently, the determination of the itineraries of the aeroplanes.

Stations for Distant Lateral Protection

In order to be able to make forecasts for periods of five or six bours and to protect the line against violent storms, it is necessary to locate meteorological observation stations at distances of from 110 to 150 kilometers from the line. These stations are selected from among those included in the meteorological organization of a country. Example: Line, Paris-Strassburg: Dijon-Mabeuge; Strassburg-Prague: Frankfort-Munich.

II. Communications

Since it is important to choose well the location of the stations, to group them in a proper manner and to make careful and frequent observations, it follows that the most difficult problem to solve in the organization of the air routes is the problem of communication. The value of the meteorological service depends on the efficiency of its lines of communication.

It is much less difficult to make observations, than to assemble ~~and make~~ prompt use of them. A meteorological report however, is really valuable only at the time of the observation.

It is necessary, therefore, to establish a very complete and perfect system of communications. This can only be brought about gradually. It is by constant effort, great patience and much expense that valuable results can be obtained.

The comunication problem consists of two parts:

(a) Assembling the information;
(b) Interpretation and use.

Assembling the Information

Central stations and mountain stations must be equipped with telephonic and radiotelegraphic systems of communication.

(a) Radiotelegraphy can alone assure sufficiently prompt transmission of information to the other central stations of the line. It alone enables the reception of information from these stations and from the stations for distant lateral protection.

Experience shows that aerial navigation cannot do without a specialized radiotelegraph system, which alone can assure a sufficiently rapid communication for the needs of air traffic and the meteorological service. Such a system is being created in France and in England.

The utilization of non-specialized telegraphic and radiotelegraphic systems in other countries is the source of great difficulties. Communications are intermittent and messages travel too slowly. Moreover, this expedient does not enable communication with aeroplanes.

(b) The principal and secondary stations are connected by telephone (except in special cases). It is necessary to obtain telephonic priority, which is very troublesome. The communications must be sent at a certain time for regular observations, aside from which they are only sent as exceptional messages, in case of storm warnings. It is important for these warnings to be transmitted as promptly as possible.

Interpretation and Use

Assuming that the information is brought together in the desired time, it is important to profit from it as much as possible. First it must be interpreted and then put to the best use. It is necessary for the contact between meteorologist and pilot to be close and constant. It must be recognized that the pilots are very skeptical concerning the accuracy of meteorological information. At the opening of a line, much patience is therefore required to win them over and obtain their confidence.

The meteorological information must be presented in as concise and simple a form as possible, easy to assimilate and to use. At each airdrome, the meteorological information received must be posted from hour to hour. The best means consists in having very legible conventional signs on a map, as is done at Le Bourget and in general at all the airdromes of the S. N. A. (Service de la Navigation Aérienne) in France. But this precaution does not suffice for utilizing the information as a whole. It is dangerous to rely on the memory of the pilots and errors of interpretation are to be feared.

It is necessary to place before the eyes of the pilot, on the aeroplane itself, a card showing graphically all the information in condensed form and indicating, by way of suggestion, the proper itinerary for him to follow and the altitude at which he should fly. It is also advisable to obtain from pilots their detailed criticism of the information furnished.

With the "Compagnie Franco-Roumaine" I use a graphic system which gives good results. Since the adoption of this system the pilots have gradually acquired greater confidence in the value of the reports, and furthermore, it is possible to keep strict watch over the work of the meteorological stations.

Communication from Ground to Aeroplane

In all of the above, we have supposed that the aeroplanes did not have radiotelegraph and radiophone apparatus enabling communications with the ground.

With the approaching use of very large aeroplanes, necessarily involving radio-electric installations, the meteorological communications will also be facilitated. There will also be an exchange of information between the ground and the aeroplane.

In general, an aviator should receive information from the ground regarding a region an hour before flying over said region (sounding by the central station). This information determines his average altitude of flight. He should also receive the reports from the auxiliary observation stations giving the visibility and the cloudiness, thus enabling the determnation of his itinerary.

This precaution is fundamentally important for the landing zone at the terminal. In fact, it must be ascertained whether the visibility is sufficient. The duty of the navigator aboard the aeroplane is to intetrpret this information and inform the pilots as to the proper route. Furthermore, instruments like the "navigraph" of Mr. Le Prieur, enable accurate checking up of the route followed. It also enables at any instant the determination of the air speed. We can therefore conceive of the possibility of accurate observations aboard such an aeroplane, which would constitute a veritable flying observatory. There will then be a means of checking ground observations on the aeroplane from which other aeroplanes flying over the course can profit greatly. This advantage, especially in foreign countries, will partially offset the lack of satisfactory ground meteorological service. The times for making the soundings must be determined by definite instructions. They must precede, at each point, the regular passage of the aeroplane by an hour. On the other hand, ground stations must always be ready to reply to questions from an aeroplane. The aviators must listen frequently for short periods, in order to allow the ground stations to send them particularly urgent information, especially storm warnings.

Such are the principles, learned by experience, which must guide us in the organization of a meteorological service.

(Translated by the Notional Advisory Committee for Aeronautics)

Texas College Students to Receive Flying Training

The Air Service Unit at the Agricultural and Mechanical College of Texas is the youngest of five units in that State, having been organized in December a year ago. The unit started this year with 102 men, but the 609 examination (physical examination for fliers) disqualified about forty of these men. The students are a highly enthusiastic bunch, all intensely interested in the course, and many of them will eventually become reserve pilots.

During the first two years at this college, students cover elementary military subjects. During the last two years they cover in the main purely Air Service subjects, including aeroplane engines, aeroplane instruments, bombing, aerial gunnery, aerial photography, radio, machine guns, artillery observation and Infantry and Cavalry liaison.

At the end of the Junior year, the students attend a six weeks' camp at some Air Service field, where they are given a great deal of back seat work as observer and also given an opportunity to take short courses in engines, aeroplanes and all other work connected with an Air Service station. Upon graduation these men are given commissions as reserve second lieutenants and ordered to active duty for a period of six months in order to permit them to obtain their flying training.

The camp this summer will be held at Kelly Field, and the Junior Class is hard at work preparing themselves for the work they will do at the camp this summer. Due to the hardships of the 609 examination, there will be only seventeen men qualified for the camp.

The Cadet Major of the Squadron, James E. Gardner, is a former Air Service officer, who left school during the war and enlisted for the Air Service. He completed his ground work course at the University of Texas, his primary training at Call Field, and his advanced training at Ellington Field. After the Armistice, Mr. Gardner returned to college, and will graduate this year in architectural engineering. He is considered one of the very best cadet officers at this institution, and it is in a great measure due to his earnest work for the squadron that such an esprit de corps in this unit has been built up so soon.

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COMMUNICATIONS AND BEACONS ON AIR ROUTES

By CAPTAIN FRANCK

Service Technique de l'Aéronautique*

Need of Communications and Beacons

The aircraft which undertakes a journey requires information as much before its departure as during the flight. During travel it is necessary to find a route marked by some suitable system of beacons.

Communications.—The information required before departure is chiefly meteorological in nature. For the navigator starts only in case the weather announced to him along the route is such that he can safely undertake the journey with the aircraft and the navigation instruments at hand. Meteorological information consists in the knowledge of the existing weather conditions at different points along the line and in a forecast of the probable weather along the route during the trip. Now the weather can be known and the forecasts made and distributed only when a system of very rapid communication is satisfactorily organized.

When he has decided to start, the air navigator should notify the point of destination and the principal landing fields along the route. The latter would then be able to have the beacons in readiness, in case they are not constantly in operation, and to assist the aviator by all possible means during the trip. During the flight, incidents may occur (such as changes in the weather and difficulty in finding the way) which will make it necessary for the aviator to communicate with the ground. The ground organizations whose duty it is to look out for his safety may have information to send him (sudden and unforseen changes of the beacon storm warnings, etc.). Finally, on arriving at his destination, he must notify the aerodrome from whence he departed, as well as the intermediate landing fields, so that at any moment they will be posted as to the position of the different aircraft.

The system of comunications of air routes must therefore comprise comunications on the ground and between the ground and the aircraft in flight. These communications must be reliable and practically instantaneous. On this account it is necessary to employ means designed for this special purpose, to the exclusion of those used for other purposes. The latter means may however be utilized in case of failure of the former and such use should be anticipated and provided for in advance. It is no less true however that the airways need their own system of communications.

Marking.—Aerial navigation can use the methods of sea navigation and also similar instruments, compass and sextant, for example. But while the sea is practically motionless or influenced by regular currents, the air is disturbed by currents which vary almost constantly in speed and direction and which change with altitude. The result is that, when the aerial navigator no longer has a landmark to observe, it is impossible for him to take account of the possible changes in his drift and to follow precisely the desired route. It is therefore necessary to place more beacons along the routes he must follow. Lastly, it is necessary to give him numerous means for determining his position or for following a well-defined route without losing it, no matter what the weather may be.

Thus the marking of air routes requires day signals, night signals and electro-magnetic or other signals capable of replacing the visual signals in foggy weather.

Means Employed to Establish Communications and Beacons

a) *Communications.*—The only means of rapid communication suitable for aviation are radiotelegraphy and radiotelephony. In fact, these are the only possible means of communication between the ground and aircraft. On the ground, ordinary telegraphy or telephony could be employed, but their use would require the installation of special direct lines at a prohibitive cost. This method of communication would be of value only if multiple telegraphy and telephony made possible by the use of high frequency on ordinary lines, should become common and thus increase the efficiency of electrical circuits to the point of considerably diminishing the cost of a direct communication by wire. This point has not yet been reached. In France, the system of communication adopted on air routes is the following:

1. *Land Communications.*—These are maintained by the aid of continuous radio sets, with a range of 800 kilometers. These sets may be employed either for telegraphy or telephony, as desired. In practice, land communications are made by telegraphy, thus obtaining greater efficiency.

2. *Communications from the Ground to Aircraft.*—On the ground sets like those described above are employed. Messages transmitted by them can be received aboard aircraft up to 500 kilometers by telegraphy and by telephony.

On aircraft, the companies use the apparatus found in commerce. The range required depends on the distance between ground stations with which it is possible to communicate. The routes now in operation can work under favorable conditions with sets having a range of 300 kilometers.

Telephony is very practical for communicating between the ground and aeroplanes. In fact, it does not necessitate acqnaintance with the Morse alphabet. After a little training, any member of the crew can use, so that it is not necessary to have a radiotelegraph operator on board. On international lines, however, it is difficult for operators speaking different languages to understand each other by telephone.

3. *Organization of Communications.*—All the important landing fields and all of those where a meteorological station is installed are equipped with a station for land communication.

All terminal fields and all those where meteorological information is gathered are equipped with radio stations for communicating with aeroplanes.

On a given landing field which needs to communicate both with other fields and aircraft, these communications may be made either by means of a single station or two different stations, according to the volume of traffic.

b) *Beacons.*—1. *Day Beacons.*—These include route landmarks and markers on the landing fields.

To indicate the routes, the names of the landing fields along the way are marked with large letters. If this is insufficient the names of important places are marked either on the roofs or on the ground. Consideration has also been given to the question of beacons for air navigators in bad weather. For this purpose, captive balloons have been sent up above the layer of clouds during foggy or cloudy weather, but up to the present time this method has not given satisfactory results.

Landing fields are marked in the following manner. The center of each field is indicated by a circle with a diameter of 50 meters in which the name of the field is inscribed.

In certain cases, four lines radiating from the perimeter of the circle indicate the four cardinal points.

The boundaries of the landing field, wherever they are not evident, are marked by spaced lines on the ground, or by disks mounted on low supports. Special markers are placed at the corners of the landing field in order to outline its contour in snowy weather. All of the obstacles which may exist are indicated by red and white pennants.

The direction of the wind is given by a movable landing-T which automatically orients itself. A flag mounted on an elevated support indicates the direction which must be followed around the field.

2. *Night Beacons.*—The marking of routes is accomplished by the aid of special lights. The form of the beam is such that they are visible at an altitude of 2,000 meters and at a distance of 40 kilometers with medium visibility. These lights are located in the vicinity of landing fields which mark the route, to indicate their situation. If the number thus installed is insufficient, others are placed between the fields. They emit series of long and short flashes, in different and characteristic combinations.

The installation of very powerful lights at certain important points on air routes has been considered. Two are now being built by way of experiment. It is expected that they will be visible at a distance of 150 kilometers with a transparency of 9.925.

Landing fields are marked in the following manner: Their situation is determined as already mentioned for the marking of routes. Obstacles are indicated by different lights. The direction of rotation is given by a luminous circle; the direction of the wind by a series of lights on the same T used during the day.

The greatest difficulty at night consists in marking the place and direction for aircraft to land. The International Aerial Navigation Convention recommends a method which consists in dividing the landing field by means of lights into three sections: a landing section, a neutral section and a section for departure. But the direction of these sections must be changed whenever the wind changes. It would be necessary, in order to accomplish this, to have quite a large night personnel, or to adopt a system of subterranean electric lights placed under

(*Concluded on page* 190)

*From Rapports du Premier Congrès International de la Navigation Aérienne, Vol. t, pp. t10-114.

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NOTES ON PROPELLER DESIGN

The Energy Losses of the Propeller—I

By MAX M. MUNK

(Technical Note National Advisory Committee for Aeronautics)

THE knowledge of the different kinds of energy losses of the propeller and of the magnitude of the losses in each single case is of great value to the designer. There are three different kinds of energy losses, and the most important has been the least often discussed in the publications of recent years. This is the friction between the air and the blade when whirled through it. Suppose the propeller to be well shaped, so that each blade element is working under a proper angle of attack. Corresponding to the induced drag of an ordinary wing, there are then coming into action the slip stream loss and other similar losses to be discussed afterwards. Besides, there is the friction of the blade surface moved through the air.

The drag coefficient which expresses the relative magnitude of this friction depends, it is true, on the blade section and on its angle of attack or, what amounts to the same thing, on its momentary lift coefficient. But the variability of the drag coefficient for reasonable angles of attack is much smaller than often supposed, the variation for different sections as well as for different angles of attack being small. There is a certain minimum of the drag coefficient existing, which it seems can always be obtained under reasonable conditions by the proper choice of the section, whether the desired lift coefficient be smaller or greater. Hence it is admissible to assume the drag coefficient C_D to be constant for all propellers under those particular conditions for which it is chiefly designed.

The energy loss produced by the drag is the sum of all these losses of each single blade element. Let i be the number of blades, b their breadth at the point considered, v the velocity of the blade element relative to the air, r the distance from axis, dr the length of the blade element, and D the propeller diameter. The entire loss per unit time due to friction is then

$$i \int_O^{D/2} v(v^2\rho/2)\ b\ C_D\ dr$$

Excepting the velocity v all quantities occuring in this expression are only moderately variable and may be replaced by their mean values for the present purpose. This velocity determines the dynamical pressure $v^2\ \rho/2$, and this pressure is the sum of the dynamical pressure of the tangential velocity and of the velocity parallel to the direction of flight, for these two velocities are at right angles to each other and hence the sum of the squares equals the square of the resultant velocity. But the square of the velocity in the direction of flight is so much smaller than the square of the tangential velocity over the greatest part of the propeller blade that it is admissible to neglect it for the following estimation of the magnitude of the drag coefficient and to make a correction for it afterwards. Substitute, therefore, $v = 2\pi\ r\ n$ where n denotes the number of revolutions per second. The loss produced by the drag remains then

$$8\ \rho/2\ C_D\ b\ \pi^3\ n^3\ i \int_O^{D/2} r^3\ dr$$

This integral has the value

$$(1) \qquad \frac{1}{8}\ i\ C_D\ \frac{\rho}{2}\ b\ n^3\ D^4\ \pi^3.$$

The thrust calculated in the same way appears

$$(2) \qquad \frac{1}{6}\ i\ C_L\ \frac{\rho}{2}\ b\ n^2\ D^3\ \pi^2.$$

The lift coefficient C_L can assume very different values as it is not restricted by a lower limit as the drag coefficient is, and its upper limit is rather high. For several reasons, however, the lift coefficient actually used with propellers intended for similar conditions always keeps within narrow limits. A lift coefficient which is too small requires too large a blade area and hence too clumsy a propeller, also C_D/C_L is thus small as a consequence. A very high lift coefficient it not compatible with a small drag coefficient nor with a small ratio of the drag coefficient to the lift coefficient. There is finally the consideration of fairly good efficiency over a wider range of constant revolutions for different conditions of flight. For all these reasons the lift coefficient of propeller blades is far less variable than would appear at first glance, and this holds even more for the ratio

$$\frac{\text{lift coefficient}}{\text{drag coefficient}}.$$

This ratio has a maximum which occurs for moderately high lift coefficients, but the actual lift coefficient will not be very different from the most favorable one, and hence the ratio C_L/C_D can be assumed constant for a rough estimation.

This leads to a covenient approximate formula for the propeller loss due to friction. For the useful work per unit of time is T V, and hence the ratio of the loss of friction, as given in equation (1) to the useful work T V where the thrust T is given in equation (2) can be written

$$(3) \qquad A\ \frac{D\ n\ \pi}{V}$$

where A is a constant or at least is nearly constant for all good propellers under their best conditions of performance.

The approximation is valid only as long as the ratio of the tip velocity n D π to the velocity of flight is great and the efficiency is fairly high. If then the number of revolutions is prescribed, the consideration of the friction alone demands a small diameter. In intend to discuss the question of the best diameter more fully in a later note, but it may be mentioned here that for an usually small diameter the loss of friction ceases to be the dominant part of the entire loss and the second kind of losses becomes important, calling for a great diameter.

The losses of the second kind are the equivalents of kinetic energy transferred to the air in the form of regularly distributed motion. The chief part is the slip stream loss. It has been discussed so often during the past fifty years that it seems admissible to state the result without repetition of the proof. The ratio of the lost energy to the useful work performed by the propeller is *

$$\frac{1}{2}\left(\sqrt{1 + C_P} - 1\right)$$

where

$$C_P = \frac{T}{V^2 \frac{\rho}{2} D^2 \frac{\pi}{4}}$$

*N. A. C. A. Report No. 114 and Technische Berichte II, p. 78.

This becomes 1/4 CP for very small values of CP but the approximation is not good for greater values of CP where it gives values that are too great. This expression for the loss is the minimum occurring for uniform distribution of the thrust over the propeller disc. This condition is not compatible with a finite number of blades, for a blade like any other wing is unable to produce a finite density of lift at its utmost end. Hence the finite number of blades involves a small increase of the induced loss.

A third kind of induced losses is a consequence of the rotation around its axis which the slip stream assumes. This kinetic energy however is not entirely lost if the propeller is in front of the fuselage and of the wings. The wings produce a kind of honeycomb effect and straighten out part of the rotation. Besides, the decrease of pressure in front of the fuselage and the radiator diminishes the drag of the aeroplane.

The additional induced losses can be taken into consideration by introducing an effective diameter D′ smaller than the real diameter and using it for the calculation of the energy losses. If, for rough calculation, the approximate formula for the loss, 1/4 C_P, is taken, the result is too great, as said above, and it may be assumed that the additional losses are already contained in it.

The entire efficiency appears now

$$\eta = \frac{1}{1 + A\ D\ n\ \pi/V + \frac{1}{2}\left(\sqrt{1 + C_P} - 1\right)}$$

or approximately

$$1 - \eta \text{ is about } A\ D\ n\ \pi/V + B\ C_P$$

where A and B are constants which do not vary greatly for

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different propellers under their most favorable conditions. A is expected to be about 3/4 C_D/C_L B to be in the neighborhood of 1/4 for great velocities of flight.

Another kind of loss is not considerable. This is the loss through the interference of the propeller and the aeroplane. This loss is not even necessarily positive. The interference in general creates a force between both propeller and aeroplane, increasing thrust and drag. This alone involves no loss. Furthermore, there is the increase of the drag of the fuselage by the slip stream. This is often added to the original drag of the aeroplane for matter of convenience, and not considered as a direct loss of the propeller, although it is to be attributed to its existence. The remaining loss of interference is small in general and can probably be neglected.

I have discussed the different kinds of energy losses of the propeller with the intention of determining the most probable value of the respective constants. The data available for this purpose are extremely scarce and unexact, but it seems pertinent and necessary to determine the most probable values and to use them until they can be replaced by some exact ones. The best method for obtaining these at present is the investigation of a stationary propeller of the same dimension and speed as an ordinary propeller, but especially designed for the test. These conditions were fulfilled to a certain extent in the tests of Dr. Schmid. * The scale of his propellers was large enough, but the speed was somewhat low. Besides, the sections investigated were comparatively poor, which is not surprising, for the tests were made as early as 1912. With one propeller, the distribution of velocity in front and behind the propeller was determined too.

This test showed that the slip stream loss was exactly 100% of the expected value. The loss due to rotation was confirmed to agree with theory to within 10% error, but here the exactness of the test was far less. This test then justifies the application of the theoretical coefficients for the determination of the induced losses,(leaving thee determination of the friction losses only to empirical investigation.

The same test of Dr. Schmid gives a lift coefficient $C_l = 0.50$ and a drag coefficient $C_D = 0.023$ calculated by means of the formulas 1 and 2. Thus C_l/C_D appears to be 22. This is in good agreement with the values known from the ordinary wind tunnel tests with wing models, if the induced drag is taken into proper consideration.

The second source of information is free flight tests which lead to the determination of the efficiency of the propeller. These tests consist in gliding tests with stopped engine, thus giving the drag of the aeroplane. This being known, flights with running engine give the propeller efficiency. With airships, the gliding is replaced by negative accelerated runs with stopped engine. The greatest error of the test comes in owing to the drag of the stopped propeller, which has to be subtracted from the drag obtained from gliding. I have previously published results of both kinds of free flight tests and refer to them, as I am better acquinted with them than with similar tests made by others. The tests with the Brandenburg seaplane gave a maximum efficiency of 71%, so did the tests with the Zeppelin airships. It has to be mentioned that both aircraft had a comparatively low speed and hence their slip stream loss was high. The method of calculation described in the first part of this note gave:

	C_L	C_D
Test of Dr. Schmid	.50	.023
Brandenburg Seaplane	.54	.024
Zeppelin Airships	.54	.025

From these data I conclude that the probable value of the minimum C_D for propeller blades is .024. As explained before, this coefficient refers to too small a dynamical pressure, the dynamical pressure of flight being neglected, and it should be applied when using the formulas 1 and 2 only. Now the mean tangential velocity is about

$$0.7\ \pi\ D\ n = 0.7 \qquad 10 \times 25\ \pi = 550 \text{ ft/sec.}$$

The velocity of flight is about 140 ft/sec, and the square of this velocity of flight is about 6½% of the square of the mean tangential velocity. The value for C_D appears from this to be 6½ too large. The most probable value of the drag coefficient is then finally

$$C_D = 0.020.$$

The presentation of this important value and of the reasons which lead me to its adoption is the main subject of this note. The value of C_L/C_D would appear to be 22. This value is not changed by the correction of the dynamic speed.

The constants are then expected to be A = 0.034 and B = 0.25. The maximum efficiency of any propeller is then about

$$1 - 0.034 \frac{D\ n\ \pi}{V} - 0.25 \frac{T}{V^2 \frac{\rho}{2} D^2 \frac{\pi}{4}}$$

For an average value of $C_L = 0.50$ this would give

$$1 - .034 \frac{D\ n\ \pi}{V} - .083 \frac{ib}{D\pi} \left(\frac{D\ n\ \pi}{V} \right)^2$$

An experimental method which also gives information on the air forces of propellers are tests with small propeller models, mostly at low speeds of revolution. These tests of course can not be used for the determination of the drag coefficient, as this coefficient depends on the Reynolds number. It has been found however that most of these tests give about the same result, so that if others give greatly different values, these tests must be considered as doubtful.

*Bendemann: Luftschrauben-Untersuchungen, Muenchen, 1918.

AVIATION IN MONTANA

Taking pride in the past advancement made in the face of unusual obstacles, Montana aviators are looking for this year to produce the greatest aerial activity yet known in this region. A number of new ships have come into the State, and various towns are preparing for the laying out of landing fields. In the past two seasons interest in flying has developed rapidly among the public, and the increase in civilian flying is expected to be rapid and large from this year on.

Although there was some flying in the State preceding the World War, the history of Montana aviation as a commercial proposition does not begin until the spring of 1919, when former Lieut. John Farrell organized the Montana Curtiss Aeroplane Co. at Bridger, Mont. The company operated two Curtiss JN4-D's successfully during the summer of 1919, but disorganized in the fall. The pilots were Farrell and W. G. Setzler.

The Inland Empire Aerial Training Corporation of Butte, was incorporated in the summer of 1919 and operated one Curtiss JN4-D. Former Lieut. L. G. Rees was the pilot. For a year the corporation was highly successful, adding two machines to its fleet, a Curtiss Oriole and another JN4-D. These machines were flown by former Lieut's R. N. Wilford and William Iverson.

Pilot L. G. Rees holds three records for flying in Montana. He crossed the continental divide with passengers in a Curtiss JN4-D five times without accident, flying at an altitude of 9,000 ft. He carried the youngest passenger ever taken aloft in Montana, Evelyn Schmidt of Whitehall, age ten weeks. This may be a world's record. Pilot Rees made the first regular delivery of newspapers by aeroplane in the northwest, carrying editions of the Billings Gazette of Billings, to Roundup and Winnett. In the summer of 1920 this company met a serious setback the Oriole being destroyed by fire.

Thereafter L. W. Lamb with Pilot Rees formed the Montana Standard Aeroplane Co. of Billings and operated successfully during the 1921 season. The company is now mapping out a large program for 1922. This company last year used Lincoln Standard Aeroplanes.

The Aero-Miles City Club of Miles City was organized in the winter of 1920-21. The Club flew two Curtiss Standards and accomplished much good work last summer. E. T. Vance and A. W. Stevenson were the pilots.

So far the various Montana aviation companies have derived their revenue from passenger carrying, exhibitions and different forms of aerial advertising.

Among the private owners of aeroplanes in the State are the following:

Perry J. Moore Jr. of Twodot, a rancher who has done considerable flying in Montana and California. He has a Curtiss Jennie.

Ex-Lieut. Seamore Anderson of Billings, who has made several long cross-country flights in his Curtiss JN4-D, and who recently was elected, Yellowstone County's chairman of the World Board of Aeronautical Commissioners.

Dr. Anderson of Roundup, who bought a K6 Standard in order to be able to answer country calls in a hurry.

Ed. Follensby of Helena, a garage man who is a flying enthusiast, and who bought a Canadian Curtiss for sport purposes.

Fletcher Woolston of Forsyth, who also owns a Canadian Curtiss with which he has done considerable flying throughout the State.

Ed. and Bob Westover of Billings, who purchased a Lincoln Standard Turnabout from the Montana Standard Aeroplane Co. and are doing good work in promoting civilian flying.

Mr. Hoil of Winnett, a banker who wanted fast transportation to and from the Cat Creek Oil fields, so he bought an OXX6 Standard.

The Montana Standard Aeroplane Company of Billings, is in position to furnish any information desired to pilots contemplating a flight into or through Montana this year, and will gladly extend it on request.

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Where Wright Aeronautical Engines Are Made

ACREAGE Approximately 7 acres, located on Main Line of Erie Railroad.

AREA 90,000 square feet.

DESCRIPTION Four floors, size 75 ft. by 300 ft. Concrete and steel heavy mill type construction, 250 pounds per square foot loading.

EQUIPMENT The plant is equipped at present to produce, and is producing approximately 300 engines per year, with spare parts therefor, and has ample capacity in addition to provide adequately for all spare part requirements for all types of engines previously produced. The equipment of the plant provides for the complete manufacture of various type engines produced, including bronze and aluminum castings, except bar steel and drop forgings. The capacity of the present plant could be expanded to produce engines at the rate of five per day in the present building. In an emergency the present acreage would allow of enough additional buildings and equipment being provided within six to eight months to produce engines of any one type in quantities of at least 25 per day.

The plant has employed during the past year an average of 450 people, which includes a complete Engineering Department and Experimental Shop.

WRIGHT AERONAUTICAL CORPORATION
Paterson, New Jersey, U. S. A.

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NAVAL and MILITARY AERONAUTICS

Joint Training of Coast Artillery and Air Service

The War Department is taking action to insure co-ordination of the Coast Artillery and the Air Service in coast defense, under the basic principles of warfare and training recently laid down. The chiefs of the two combatant arms concerned have been instructed to consider together the question of joint training, with a view to carrying out experiments in joint training and tests of material during the coming summer.

The war with Germany furnished such an exhaustive test of the powers of mobile troops that the doctrines of training for such troops were firmly established. Coast defense, however, was not so extensively tested, and many questions of the best methods and material to be used were not solved in battle. Since the war various experiments, such as the bombing of warships, have indicated the increasing power of aircraft in coast defense. It is with a view to developing the potentialities of this new arm, as well as to insure properly co-ordinated training, that the War Department is taking action.

Both branches undoubtedly have an important role in coast defense, and tests will be for the purpose of obtaining coordination in their training. It is expected these tests will include:

(a) Anti-aircraft target practice against air targets to determine the vertical range at which bombing planes could operate without being subjected to effective fire.

(b) Bombing practice against coast defense installations.

Scott Field is Working on Two Racing Balloons

Scott Field is constructing a second balloon for competition in the U. S. balloon race which is to be held in Milwaukee, Wis., next month. The race was to have been started at Milwaukee on May 8 and the local aviation camp was to have been represented by one balloon. With the changing of the date from May 8 to May 31, permission was given to A. Leo Stevens, the civilian aeronautical officer at the field, to construct a second balloon.

The first balloon is nearing completion and the second, which will be a sister ship, has been started. The ships will be known as U. S. No. 2 and U. S. No. 3.

Each of the balloons will have a capacity of 80,050 cubic feet and will be 105 feet from bottom of basket to top of the balloon. Word of the changing of the date for the starting of the balloon race has just reached Mr. Stevens from the Aero Club of New York.

The balloons which will be entered in this year's race from Scott Field will be the second and third ships ever entered in a race. Mr. Stevens who is supervising the construction of the two ships at Scott Field also directed the manufacture of the first ship which was entered in the race at Omaha, Neb.

A large crew of men are busily engaged on the balloons at Scott Field.

The 318th Pursuit Group, Organized Reserves

The 318th Group, Pursuit, Organized Reserves, with headquarters in Indianapolis, has three squadrons, the 462nd, 463rd and 464th in Indiana (Kokomo, Wabash and Indianapolis) and the fourth, the 465th, at Louisville, Kentucky. At present there is only one Regular Army Air Service officer detailed with the Group.

The 464th Squadron at Indianapolis is the only organization nearly approaching its full complement of officers. Some enlisted men have already been signed up by recruiting officers appointed within this squadron, and all details pertaining to the squadron are being studied and rapidly mastered by the flight officers in order that the unit may begin to function as such. The remaining squadrons in Indiana have only enough officers assigned, or available for assignment, to compose a full flight in each.

The former Air Service officer presents a different problem, regarding applications for Reserve Commissions, from a line officer. The reserve line units have a more or less full quota of officers, whereas the Air Service units are sadly lacking in the available number of commissioned personnel. Being a comparatively new branch, there are no officers of long experience such as may be found in the Infantry, for instance. There are very few men holding Reserve commissions in the grade of captain, and hardly any in the field officer grade.

The work of an Air Service officer is considered very hazardous by wives and families of ex-aviators, most of whom have acquired the first named since leaving the service, so that pressure is brought to bear upon those men who would like to try their "hand" again by entering the A. S. R. C.

The majority of men now holding reserve commissions are those who completed their training just before the armistice or remained in long enough to get the rating. The old flyers look askance at the Reserve program, that is, those who have remained in touch with Acts of Congress regarding the Reserve Corps. Once a flyer, there will always be an attraction for them in flying. So to induce these valuable men to re-enter the game as an officer in the reserves, they must have a definite assurance of a sufficient amount of flying. With this assurance, it is believed there will be applications and enough men commissioned to fill the quotas desired.

The Aero Club of Indianapolis, most members of which are numbered among the personnel of the 464th Squadron, are endeavoring to acquaint all former service men, by personal contact and publicity gained in their activities, of the fact that the 464th is going to fly—and very shortly. The dedication of Schoen Field on Sunday, March 26th, was attended by all members of the organization. Schoen Field, at Fort Benjamin Harrison, is named in honor of an Indianapolis boy who was shot down overseas. This dedication marked the first official appearance of the 464th.

One steel hangar is being erected at the field, and material for two more will arrive shortly. There will be about ten JN6H planes, one DH4B, and probably a Fokker, for use by the squadron this spring and summer. This should increase the enthusiasm and esprit not to say applications for Reserve Commissions.

Death of Major Simons and Lieut. Fitzpatrick

Two Army Air Service pilots made the supreme sacrifice in order to advance the science of aviation—Major John W. Simons, Jr., and 1st Lieut. Gerald H. Fitzpatrick, who were instantly killed near Ellington Field on April 3rd, when the planes they were piloting collided in the air.

Major Simons, who was 35 years of age, had 14 years' service in the Regular Army, being appointed a 2nd Lieutenant in the Infantry on January 4, 1908. On March 3, 1914, he was promoted to the grade of 1st Lieutenant. During the World War he was detailed a Captain in the Aviation Section, Signal Corps, in November, 1917, and he was promoted to the grade of Major on February 23, 1918.

He was sent to Rockwell Field, San Diego, Calif., for flying training, in April, 1918, and completed same on July 15, 1918, when he was rated as a Junior Military Aviator. From Rockwell Field he was sent to Langley Field, Hampton, Va., as a representative of the Bureau of Aircraft Production in command of all aircraft experimental activities at that station. His next assignment was that of Commanding Officer of Park Field, to which station he was sent in November, 1918, remaining there until September 18, 1919, when he was assigned to duty as District Material Disposal and Salvage Officer at Buffalo, N. Y.

In August, 1920, he was transferred to the Office of the Chief of Air Service, Washington, D. C., for duty as Assistant Adiministrative Executive. Desiring to receive further flying training, his application to take the advanced course in pursuit training at Ellington Field was approved, and he proceeded to that station in January, 1922.

Major Simons was considered an excellent pilot, and made many long cross country flights. Of a genial disposition, he was well liked by all who came in contact with him, and his many friends in Washington and elsewhere will keenly feel his loss.

Lieutenant Fitzpatrick was 24 years of age and a native of St. Louis, Mo. He was appointed a flying cadet in October, 1920; and was sent to March Field, Riverside, Calif., for flying training. He completed his primary training in April, 1921, took the examination for a commission in the Air Service, Regular Army, and received an appointment as 2nd Lieutenant on August 4, 1921, being shortly thereafter promoted to 1st Lieutenant. In December, 1921, he was sent to Ellington Field for advanced training in pursuit flying.

The Air Service sends its condolences to the bereaved relatives of these two officers.

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FOREIGN NEWS

London-Brussels Service

The Instone Air Line, Ltd., has now been approved by the British Air Ministry as the company to operate a subsidized air service between London and Brussels.

Night Flight Croydon to Lympne

The first flight by night over the British portion of the Continental Air Route (Paris, Brussels, Amsterdam, etc.), was carried out by an Air Ministry machine in order to test the ground organization which has been established for commercial flying by night between London and the Continental capitals.

The aeroplane which carried eight people, including a navigator, wireless officer, and the Air Ministry officials responsible for the lighting and wireless arrangements of the route, left Biggin Hill about 8:30 p. m., flew to the London Terminal Aerodrome, Croydon, and landed there. The Pilot in charge, who has had great experience, expressed the view that the flood lighting arrangements on the aerodrome, by means of dispersed searchlight beams, together with the illuminated Landing "L's", were the best he had seen and made landing as easy by night as by day.

The aircraft left Croydon Aerodrome about 9:20 p. m. and steered a direct course for Lympne Aerodrome on the coast. Temporary Aerial Lighthouses were in action at Tatsfield and at Cranbrook, and these were easily picked up. Shortly after passing the Cranbrook Light the Pilotage Light on Lympne Aerodrome became clearly visible. The machine then flew over Lympne Aerodrome and continued over the Channel towards St. Inglevert, the first aerodrome on the French side. The Marine Lighthouse at Cap Gris Nez, which had been visible as soon as the aircraft was over Biggin Hill, gave an excellent leading mark and very soon the French Aerial Lighthouse on St. Inglevert Aerodrome also came in sight. Turning back on its course the Aeroplane then crossed the coast near Folkestone and headed direct for the Pilotage Light at Lympne at which aerodrome an easy and smooth landing was effected. Leaving this station at about 11:30 p. m. a course was re-traced to Croydon, the lights of the Terminal Aerodrome being easily picked out from all the mass of lights of Croydon and London generally. After circling Croydon Aerodrome the aircraft was headed for Biggin Hill where a landing was effected with the help of wing tip flares and ground flares.

The general impressions of those who made the flight were that it is easier to find a course by night than by day and that provided the Continental ground organization is as good as our own there should be no difficulty whatever in commercial night flying over the London-Paris route.

F. Handley Page States German "Gotha" Was Copy

London—The Handley Page Co. has a claim before the Commissioners on Inventors' Awards concerning the "O" and "V" type of biplane as made by others during the war, by direction of the wartime authorities.

F. Handley Page, managing director of the company, testified in connection with the claim that the German "Gotha" was a copy of his machine and until the Germans captured a Handley Page, all complete, and were able to fly with it, they were not conversant with the structural details or convinced of the aerial dynamics in regard to big machines.

Austria: Conditions Governing Flight

In consequence of the admission of Austria into the League of Nations the provisions of the Treaty of St. Germainen-Laye relating to Allied aircraft flying over Austrian territory are no longer in force.

Foreign aircraft flying over or landing on Austrian territory must be provided with a permit issued by the Austrian Ministry of Roads and Communications.

China's Air Service Wilting

Chinese "finance" was ever a thing to be marvelled at, and one of the latest enterprises to suffer at its hands appears to be the Air Service which was inaugurated last year under such favorable auspices with the assistance of Messrs. Vickers, Ltd. It seems that the cash provided, which should have gone to run the service to a commercial success, has filtered away through the Government inaptitude until nothing remains for wages, coupon interest, or anything else —without some financial miracle happens. From latest reports it looks as if the whole scheme may easily become another monument to Chinese methods of how not to do it.

London Continental Air Service

According to London newspapers, thirty new air expresses are to be "put on" the London Continental Air Service this year to cope with the great increase of traffic. The British contribution includes a number of an improved type of twin-engined Handley Page machines, each for 12 passengers. In addition, there will be a fleet of machines built by the DeHaviland Aircraft Company.

A new fleet of 14-seater Goliath airplanes will be operated by a Belgian company between London and Brussels, while a week or so hence will witness the trials of the first of a fleet of four-engined 25-seater super air expresses that one of the French companies is building. The airways are also to be extended, and instead of Paris being the terminus, it will become a junction, with services running to Marseilles, Lausanne, Warsaw and Casablanca, in Northern Africa, while it is hoped to extend the airway on the British side from London to Manchester and then across to Dublin.

Russo-German Air Traffic Company

A statement in a Russian newspaper announces the formation of a Russo-German air traffic company, which will begin operations by establishing an air route between Moscow and Konigsberg, to connect with the Berlin-Konigsberg express train services. An agreement has already been concluded between the Russian commercial delegation in Berlin and German interests, among whom are Herr Rathenau's organization, the General Electric Company, the Hamburg-Amerika Line, and the Zeppelin Company. Germany is to recover full freedom in the matter of the construction of non-military aircraft, and the establishment of air services beginning in May.

Mexican Air Service

Trade Commissioner P. L. Bell, at Mexico City, has sent to the Automotive Division, Department of Commerce, a translation of a permit recently conceded by the Mexican Ministry of Communications and Public Works to the representative of the Cia. Mexicana de Transportes Aerea, S. A., for the establishment of an airplane service between Mexico City and points in the States of Vera Cruz and Tamaulipas. In view of similar permits ready to be granted in the near future, this one may be taken as a very good example of what parties interested in the development of commercial aviation in Mexico may expect in the way of Government permits and their conditions. It should be noted, furthermore, that this permit is not an exclusive one and does not carry the usual features of the old-time "concession."

Netherlands Market

Mr. Joseph W. Vander Laan, Secretary to American Legation, The Hague, reports that the market for American aircraft in the Netherlands is centered in the Army, the Navy and the Colonial aviation, and in the Royal Dutch Air Service Co., known abroad as the K. L. M. While the needs of the Dutch Army aviation are relatively small, and the K. L. M. has definitely decided that during 1922 it will fly Fokkers, American aircraft builders may be able to compete successfully for contracts from the Navy and the Colonial aviation.

Czechoslovakia

Engineer Janak, head of the Automobile and Flying Department of the Ministry of Social Welfare, returned from Berlin on February 17th. He concluded with representatives of the German Government a provisional agreement on a reciprocal basis regarding regular air service, passengers and goods, between Prague and Berlin. The agreement, it is said, will be signed in March. The governments of the two countries will each select a company to participate in the service, which will either be alternatively or simultaneously in opposite directions.

This means that as soon as Germany is permitted, by the Peace Treaty, to make international flights (end of 1922) German machines will be allowed to fly to Prague and over Czechoslovak territory. A new flying company will be formed at Prague, under the protection of the Legio Bank, with a capital of 8 million kronen. Deputy Rychtera will be president of this company. The amount of the government subsidy, which will be paid to this company, has not been fixed, but it is expected that it will be equal to that allotted the Franco-Roumanian Company.

This new Czechoslovak aviation company will use, as far as possible, aeroplanes of Czech manufacture. Recently the "Aero" Aircraft Factory at Prague has successfully tried out an air transport limousine, which will probably be purchased by the new aviation company. The "Aero" limousine has a wing area of 52 sq. meters and a carrying power of 40 kilos per sq. meter, weight 1300 kilos, and will have a capacity of 5 persons and 100 kilos of baggage, and will carry petrol for four hours' flight. The engine is a German 260 h. p. Maybach motor. The Military Aircraft Works are also working on an air transport limousine designed by engineer Smolik.

Prague-Vienna Service

It is reliably reported that negotiations have begun between representatives of the Czechoslovak and Austrian Governments regarding a regular air service between Prague and Vienna.

Buenos Aires-Montevideo Service

The first trip of the new bi-weekly aeroplane service between Buenos Aires and Montevideo took place on December 17th, the distance of 220 kilometers across the River Plate being covered in approximately 1 hour and 10 minutes. The aeroplane has room for four passengers. On the first return trip 1,270 letters were carried to Buenos Aires.

A very successful aviation meet was recently held in Montevideo. Two Avroa, two Spada, and a Salmson were piloted by daring aviators, who thrilled the audience by corkscrew and Immelmann turns, the "falling leaf," and "looping the loop."

Honduras School

The Young Men's Club, which is interested in the advance of aviation in the country, is about to order aeroplanes from Italy for the equipment of the first Honduran School of Aviation.

Bristol Engines in France

We understand that the Bristol Aeroplane Co., Ltd., have concluded arrangements for granting the sole license to manufacture the 400 H.P. "Bristol" Jupiter radial air-cooled aero engine in France to the well-known Gnome & Le Rhone Engine Co. The announcement is of more than ordinary interest from the fact that this is probably the first occasion upon which the manufacturing license for an aero engine of British design has been acquired by a French manufacturer and is an indication of the high estimate formed in regard to the "Bristol" engines by the French aviation experts. The fact that the "Bristol" Jupiter and "Bristol" Lucifer engines are the only two air-cooled engines which have ever satisfied the strenuous conditions of the British Air Ministry Type Tests, coupled with their excellent record for reliability and performance in the air, has created a great impression in Continental aviation centers. The selling rights for the "Bristol" Jupiter engine in France and many of the countries of Europe have also been ceded to the Gnome & Le Rhone Co.

Planes Assist Seal Catching

A Grand catch of 50,000 seals is recorded from Montreal as the first week's haul of the Newfoundland Sealing Fleet, which was guided by aeroplanes to the location of the herds.

France to Have a 1922 Aero Salon

It has now been definitely decided by the Chambre Syndicale des Industries Aéronautiques that they will hold an Aero Exhibition in Paris this year. It will be, as before, at the Grand Palais, and although the actual date is not yet settled, it will probably be in December for a fortnight, although there are many who would prefer September to be the selected month.

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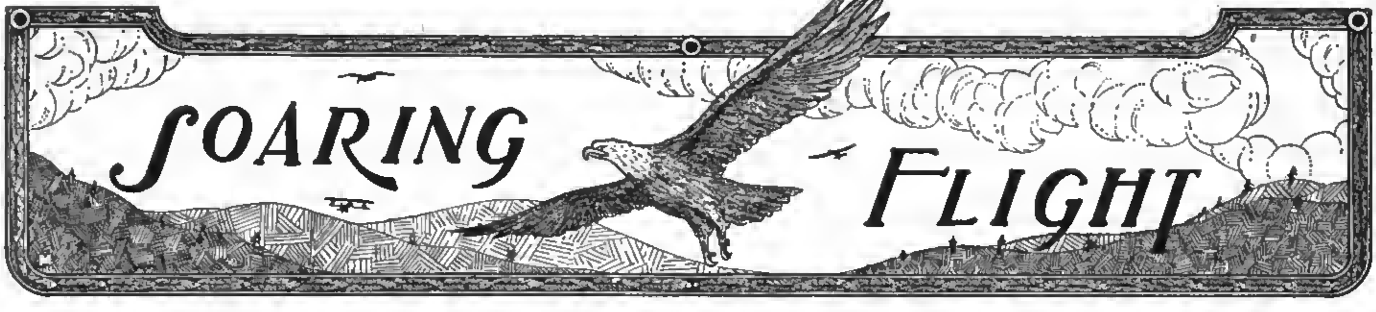

SOARING FLIGHT

A Study of the Vulture and Golden Eagle

(*Continued from page 7*)

THE Eagle fears none but man, and even him he fears but little. Brought to bay, he does not hesitate to hurl himself at his enemy. In captivity he is at first exceedingly dangerous, and his ferocious temper renders him an untamable animal. It requires great skill to succeed in impressing him with fear, and when he becomes excited he will fight to the death.

Nature has created him to keep down undue increase. In this he is like the tigers, the sharks and the pike. This tyrant of the air is abundantly provided with all the weapons necessary for his murderous life. His arms consist of eight talons as long as a finger, curved and sharp-pointed and moved by terrible muscles. His much-hooked beak serves him to carve the animal perforated by his talons.

His wings are large and exceedingly strong. They are preeminently adapted to sailing flight. He rarely beats the air unless there is no wind, or unless he is loaded with a prey. Pen is powerless to depict the majesty of his gait, the amplitude of the immense circles which he sweeps in the air. At times he is absolutely motionless. He is examining the field or watching a prey; then suddenly he drops hundreds of yards. He falls like a meteor with the velocity of bodies falling through space.

The speed is such that it produces a sound difficult to describe. It is not like that of a bullet or of a cannon ball, but must be heard to get a true conception. Then, when within a dozen feet of earth, his wings' great strength safely checks his descent; and this at once, in half a second—merely by expanding his wings to their full spread.

His skill is wonderful; never a miss makes he. His eyes are excellent. From high up in the air he spies out the rabbit hiding in the thicket, or the inconspicuous duck swimming among the reeds. He uses his talons, the arms with which he kills, in a remarkably efficient manner. In captivity, when he is hungry, with a single claw he catches on the fly the morsels of meat thrown to him, and never misses them if they pass within his reach.

His movements have all the precision of those of small birds. He is free, quick, sharp, and powerful in his movements. Above all, his power of taking in all at a glance is very remarkable. As the motor-muscles of the eyeball are but little developed, he is compelled to turn his head whenever he desires to see anything sharply. His head then assumes splendid poses. His eye, that brilliant gem set under a deep arch, darts out lightning glances. His curved beak, his savage air, his sharp head-feathers, bristling up and forming a diadem—all that ensemble of vehement sweeping outline—make the Eagle a model of audacity and of power.

He lords it over a territory which he always selects of vast extent. All the smaller mammals dread him; the young of larger animals fear to be seen by him; the young chamois crouches up to its dam, the old bucks call the herd and stamp their feet with fury. Man himself, in infancy, has been attacked by him.

He is intelligent only from a hunting point of view. A very interesting spectacle is that of a family of Eagles making a raid in order to furnish the nest with provisions. The male is up a hundred yards in the air, quite motionless. The female is beating the thickets. Her flight while doing this has an ease of great elegance. She follows the undulations of the ground without effort, glides from one hill to another, descends and reascends the mountain slope. When a prey appears the two spouses are upon it at the same time. It often happens that a hare starting up 10 yards from the female is caught by the male, who was stationed a hundred yards away in the air. He dives head-formost, is upon the prey in four or five seconds, picking it up on the fly. If she is in the mountains, he first plunges into the valley with his load, and with great wing beats reascends to his eyrie. There the spoils are divided, and this never takes place without much dispute, despite the matrimonial bonds.

Hannover Glider Won Highest Awards

Mr. George Madelung, now connected with the Glenn L. Martin Company, Cleveland, Ohio, took part in the management and was in the Rhoen during the soaring competition held in Germany last year. In view of the statements published in AERIAL AGE crediting the highest awards to the Aachen Soaring Monoplane, Mr. Madelung points out that a glider designed by him, the Hannover, won the highest awards, which were 60 per cent more than those won by the Aachen.

As to the record breaking flight of Mr. Klemperer, which took place on August 30, 1921, this record was exceeded on September 5 by the Hannover glider which made a flight of 15 minutes 40 seconds in which it covered a straight line distance between starting and landing points of 4⅗ miles.

Wing Areas and Weights of Soaring Animals

Perhaps the heaviest of the soaring fliers is the California Vulture which often weighs as much as twenty pounds. Turkeys often weigh twice this, while the albatross is occasionally found weighing eighteen pounds. Still heavier than these may have been the Petrodactyl (now extinct) which, however, weighed no more than thirty pounds.

No flying creature that ever existed appears to have been as heavy as the combination of a man with the lightest structure that can be made to support him, and this fact often has been cited as an argument against the possibility of human flight. But in this connection it is a significant fact that the areas and the power required to support a given weight steadily decrease in passing from the smaller flying animals to the larger.

The most conspicuous features to be discerned in a study of soaring bird forms are the usually extreme length and narrowness of the wings, the lower sustention per unit of area than prevails with flapping fliers and a quite different type of curvature to the wing sections.

The pterodactyl, a bird-like reptile, which is known only from the discovery of fossil remains in strata of the Cretaceous period, measures in ordinary specimens about twenty feet from tip to tip. They were, however, very light, the wing bones that have been found being mere shell-like tubes of large diameter and extreme thinness. (The fact that there once existed a larger flying animal than any existing today has been held to prove a greater density to the earth's atmosphere in pre-historic times.) Calculations of the power exerted by this reptile in flight show that it required .036 horsepower. Its weight being thirty pounds and wing area twenty-five pounds, its weight is only 1.2 pounds per sq. ft. and 833 pounds per horsepower.

Table of Soaring Animals

Name	*Weight (pounds)*	*Wing Area (sq. ft.)*	*Pounds per sq. ft.*
Cabbage Butterfly	.000169	.00942	.0179
Maiden Dragon Fly	.000423	.01415	.0298
Laughing Gull	—	—	.62
Sparrow Hawk	.549	.69	.79
Herring Gull	2.18	2.41	.9
Stork	4.78	4.57	1.04
Scavenger Vulture	—	—	1.052
Turkey Buzzard	—	—	1.052
White Pelican	—	—	1.052
Pterodactyl	30.	25.	1.2
Sea Eagle	10.57	8.05	1.30
Griffon Vulture	—	—	1.456
Eared Vulture	—	—	1.456
Condor	17.	9.85	1.726
Flying Fox	2.91	1.65	1.76
Flamingo	—	—	1.818
Albatross	25.36	8.12	3.12

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RADIO DIGEST

Radio Equipped Planes

Spokane, Wash.—Radio equipment is to be installed at once in aeroplanes of the United States Aircraft corporation here, acording to announcement by C. H. Messer, president.

With the equipment, capable of sending or receiving messages for 1,000 miles, the ships can be at all times in touch with the field. Receiving equipment will consist of wireless telephones. Additional safety in operation and greater usefulness will result from the installation of the phones, Mr. Messer said.

All pilots and students of the company must learn radio as a part of their course, according to Mr. Messer, inasmuch as he considers it one of the big steps in the advancement of aviation.

"By means of the wireless we will at all times be in touch with the local field," Mr. Messer said. "It will be impossible to lose the way or the sense of direction in fog or heavy smoke from forest fires.

"As soon as we have the equipment installed and under way, we will invite the public to the field to witness the demonstration of the men in the ship at a distance talking to persons on the ground.

"In addition we plan to put a receiving set in an automobile and go to all larger cities of this district and give demonstrations.

"Instruction work of a preliminary nature will be given at our Modern Auto school, but later pilots and students will be given their work in the air while actually flying.

"By means of equipment we are planning to install at the field, a device known as the 'radio compass.' It is so worked that a pilot, no matter what distance he is flying, can locate his own field and tell the exact direction in which he is traveling. The equipment we will use has been given an initial tryout."

Congress to Rush Bill for Control of Radio

Congress will expedite legislation vesting control of radio communication in a general advisory board under the Department of Commerce, it was declared, following conferences of Secretary Hoover and Congressional leaders.

Senator Kellogg (Minn.) and Representative White (Me.) will have charge of the radio bill now being drafted under Mr. Hoover's direction by a committee of experts.

Mr. Hoover's reports today showed that radio users are increasing at a tremendous rate and that applications of amateurs continue to pour into the Department of Commerce asking for licenses to set up transmitting stations.

Health Hints by Radio

A semi-weekly "radio telephone health bulletin service" has been inaugurated by the United States Public Health Service. It is planned to broadcast every Tuesday and Friday through the naval radio station at Anacostia, Va., a message of advice or how the average man and woman may insure continued good health. Under very favorable weather conditions it is expected that the messages will be heard on the Pacific Coast, in Europe, and the north parts of South America.

Radio Telephone Broadcasting in France

The popularity of radio broadcasting has extended far beyond our own borders. England is doing a little radio telephone broadcasting, so is Berlin, and the idea is taking real shape in France. We learn from a recent news dispatch that 20 ballet girls danced to music played 25 miles away, as a feature of a matinee. The performance was witnessed by Prof. Branley, the pioneer wireless worker, and ex-President Poincare.

Guiding Radio Waves

A Ukranian engineer is reported to have discovered a method by which radio messages may be sent to a definite receiving station without the danger of being intercepted by other stations. It is stated that by means of a simple apparatus the so-called "locker power line" of the magnetic field may be straightened out and grouped into parallel rays. These rays are said to do away with the necessity of aerials. If this report is true, it seems that we are on the verge of a new epoch in radio. However, we shall have to wait for complete details before passing judgment on the merits of this new invention.

Medical Servico via Radio

Arrangements have now been made whereby any ship provided with a radio outfit can receive prompt medical service from the United States Health Service, through one of several Radio Corporation of America stations and other stations. When it is remembered that only a small proportion of the total number of ships equipped with radio have a ship doctor, the value of medical service via radio becomes apparent. The ship in need of medical service can now call up the nearest radio station, state the nature of the case or cases requiring medical attention, and receive a diagnosis of each case and complete instructions as to treatment within a few minutes.

High-Power Vacuum Tubes

In connection with Great Britain's Imperial Chain—a world-wide radio system that has been under way for a long time—the Technical Committee recommended the use of high-powered tube installations. A considerable amount of very valuable work has been carried out in the past year by the British Admiralty, working in conjunction with the Mullard tube builders. Much progress has been made in the construction of silica tubes, which have now been made in 10-kilowatt sizes. The result of this work will undoubtedly be seen in the forthcoming year. We may expect a large number of land stations operating on valves of large power.

Crystal Acts as Valve in Receivor

The simplest radio receiving set, states Jack Binns, in the N. Y. *Tribune*, is the crystal detector, capable of receiving music and speech for a distance of twenty-five miles under practically all conditions and wireless telegraph code over very great distances.

In previous articles on this page I have described aerials of various types, protective devices for them, and the manner in which electro-magnetic waves are produced and propagated through the ether. In this article I propose to give a description of the action of the crystal detector in the receiving set.

In the first place there are a number of ways in which the crystal detector can be used: the simplest is by placing it in series with the aerial and the ground, with the telephone receivers shunted across it. This is a very unsatisfactory method, because it does not permit one to tune out any unwanted signals, and the consequence is that a great deal of interference is obtained.

The remaining methods of utilizing the crystal can be roughly summarized under the general heading of "tuning apparatus." This may consist of what is called a "single circuit" or a "double circuit," the latter being the best of all. The single circuit may consist of a tuning coil, with one or two sliders, or a variometer, or a honeycomb coil. In the latter case a condenser in series is required in order to obtain tuning. A double circuit may consist of a loose coupler or a vario-coupler.

Now, this tuning apparatus is required in order to put the entire receiving equipment into electrical resonance with the incoming wave. This can best be illustrated by using the analogy of two tuning forks. If you get two tuning forks of exactly the same pitch and place them at different ends of a room and then strike one, the other will vibrate in unison with it. If, however, you take a tuning fork which has a higher or lower pitch it will not respond in any way to the vibrations of the other. This is exactly what happens in the tuning circuit, and the adjustments that you make put that circuit into the same "pitch" or resonance as that of the incoming wave from the broadcasting station.

It can be readily seen, therefore, that with a single circuit, which must necessarily include the aerial, as close tuning cannot be obtained as with a double circuit, for this reason: the aerial receives all waves that pass over it and the current received is passed to the ground. Those currents that are in syntony with the aerial circuit will be recorded through the detector in the telephones. Of course, it is impossible to get 100 per cent efficiency in such tuning, and some of the undesired waves passing over the aerial will be recorded also, despite the fact that they are not of the same wave length as that to which the aerial circuit is attuned.

A double circuit means the addition of a secondary oscillating circuit. In the case of a loose coupler, this means the secondary inductance and a variable condenser shunted across it. The secondary circuit is put into resonance with the primary or aerial circuit bv adjusting the number of turns in the inductance and the amount of caoacity in the condenser.

It will thus be seen that while the aerial circuit may respond to some of the nnwanted waves, the chances of the secondary doing so will be very remote. By varying the coupling between the primary and the secondary, these unwanted signals are still further eliminated. Similar action takes place in a vario-coupler.

This is the condition that we are now confronted with, so far as the oscillating circuits are concerned. The next job for

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the receiving instrument is to record the waves that have been received. As these waves have a frequency of 830,000 cycles per second, in the case of the broadcasting stations using a 360-meter wave, it will readily be seen that they are far too high for the telephone receivers to respond to, and, moreover, they consist of alternating current. The problem is to reduce this so that the telephones can respond and reproduce vibrations within the range of human hearing.

This is the job that the crystal detector has to do, and the most sensitive of all forms of crystals used for this purpose is galena, which is a sulphide of lead found in large quantities in the Middle Western States. Galena has the peculiar property of permitting a current of electricity to flow through it in one direction only. It completely checks current flowing in the opposite direction. In other words, it acts in the electrical circuit just in the same manner as the valve does in a water pipe system. The valve permits the water to flow freely in the direction that it is desired to have the water go, but if by any chance or circumstnce there should be a back flow of water the valve immediately closes and stops the back flow from going any further. Galena does the same thing in the electrical circuit.

We have now got the condition where the high frequency alternating radio currents are literally chopped in two by the detector and only half of them permitted to flow through the telephones. We have, therefore, a pulsating instead of an alternating current, and the pulsating current is flowing in one direction only. The groups of pulsations act together and cause the telephone transformer to reproduce sounds that are audible to the ear, and it is in this way that we get a reproduction of music and voice.

I have often been asked why it is that a crystal detector will receive wireless telegraph signals over very great distances, but yet is reliable so far as music and speech are concerned only over distances of approximately twenty-five miles. The answer to this question is not so difficult as it would seem. When we are dealing with telegraph code we have a current of constant amplitude sending out the dots and dashes. In other words, the "tone" or "pitch" of the signal never varies. In the case of the voice or the music we are not only dealing with varying amplitudes of sound, but we are also dealing with loud and soft inflections.

Lightning Danger to Antenna Small

If your radio installation is not already installed according to regulations you should attend to the matter at once, says G. K. Thompson radio superintendent of the Amrad Co., in the New York *Herald*. The regulations are in force the year round and should be complied with as far as possible. That they are not complied with is a well known fact, but this negligence means that after the first thunderclap thousands of people will storm dealers in radio equipment for protective devices and their meager supplies will be exhausted within a few hours.

One of the first questions that comes into the mind of the would be radio user concerns lightning. "Will my antenna attract lightning and cause my home to be struck?" he asks. To the general public wireless and lightning seem to be twin brothers—probably because the manifestations of both are uncanny and mysterious.

Hoisting a radio antenna over your property does not endanger your dwelling, your instruments or your family if a few simple precautions are observed. You have never felt apprehensive over the presence of the telephone wire running from the pole on the sidewalk to your house. You do not regard the bell wire circuit running from the front door to the kitchen as a lightning conductor, nor have you been nervous over the presence of a wire clothesline in your back yard, the tin roof over your head or the metal gutters and leader pipes.

All these common and familiar metal surfaces and conductors will convey electricity from point to point. The average radio antenna differs very little from these other conductors and objects, and in so far as lightning is concerned the radio antenna is much less likely to be struck during a heavy thunder storm.

Let us consider the electrical action that takes place in the antenna before and during a summer thunderstorm. There is always a certain amount of atmospheric electricity present in the air. In cold weather the amount is very slight and manifests itself in the radio set by what is familiarly known as static. When warm weather comes atmospheric electricity is generated in much larger quantities.

The intense heat of the summer sun evaporates the moisture on the surface of the earth and water from ponds and lakes very rapidly. This evaporated moisture or vapor, becoming heated, rises to the upper atmosphere and upon reaching the higher levels, where the temperature is lower, the water vapor condenses into minute drops of moisture and forms clouds. Each moisture particle becomes charged with a very small amount of electricity.

As the moisture particles in the upper air become more dense the particles crowd together and one particle combines with another. This combination increases the electrical charge on each particle until finally a thunder cloud is formed which is very highly charged with electricity.

It is a known fact that when thunderstorms are in formation electric discharges occur within the cloud. These discharges are popularly known as sheet lightning. Every time such a discharge takes place radio waves are emanated and these waves impinge upon your antenna, causing a sharp crash or crackle in the telephone receivers if you happen to be listening in.

A thunder cloud must be regarded as a huge bubble containing electricity. Discharges are constantly taking place within the bubble and increasing in size. When a certain critical point is reached the bubble bursts, the pent up electricity discharges in one swoop to the earth and we hear a mighty thunder-clap. If this lightning bolt strikes within one-half mile of your antenna, considerable current will be induced in your aerial system. This induced current will pass harmlessly to the ground and you will be unconscious of its presence if you have taken the proper precautions.

Let us consider the great bubble once more. If we prick tiny holes in this bubble while it is in process of formation, the pent up electricity will gradually discharge. If we prick enough holes in the bubble, the electric charge may leak away so fast that the quantity of electricity within may never reach the point where the bubble will burst. The function of the common lightning rod and the properly grounded or protected antenna is to prick holes in the great electric bubble in the sky and convey its charge silently to the ground. For this purpose the average radio antenna is exactly as effective as the lightning rod.

"What will happen if a lightning bolt actually strikes my antenna?" is a familiar question. Let us consider the nature of a lightning bolt. The heavy thunderclap which attends its appearance gives the impression of tremendous energy.

It is true that lightning is destructive, but as a matter of fact its bark deceives one of its might. The average lightning bolt contains about as much energy as represented in a pint of gasoline. The only difference is that the energy of lightning is exerted instantaneously.

Take, for instance, a cupful of gasoline and ignite it under a saucepan containing a tallow candle. The heat of the burning gasoline will melt the candle. The phenomenon is silent and harmless. Take another cupful of gasoline and dump it into the gas tank of the family flivver, crank up, and drive thirty miles an hour, head-on into a concrete wall. The effect is startling.

Even Henry Ford himself could not put together the remains and make them rattle once more. Yet the energy involved was no more than that necessary to melt the tallow candle.

A bolt of lightning represents an electrical collision. This accounts for its many strange antics, such as stripping the soles from shoes of persons struck, smashing crockery or ripping off wall paper.

Uses Electric Main to Pick Up Chicago

Few amateurs in this part of the country even with the best of aerials have been able to pick up KYW, the Westinghouse station at Chicago, not alone because of the air line distance of more than 700 miles, but also because of the interference of nearer stations on the same wave lengths. At least one radio listener in the city, however, who operates without any aerial on his roof, has caught the fleeting strains of the Illinois station.

Thomas C. Shotwell of 611 West 156th street, who has taken down his aerial and for more than a month has been getting all his concerts from an electric light socket, succeeded the other day in picking up KYW, but before long WJZ came crashing in from Newark and KYW ceased to sing. Other amateurs, following in Mr. Shotwell's footsteps by using an electric light socket, also have reported good results, but the system, as described by the Washington Heights experimenter, does not work in all sections of the city, and is not of value in the case of crystal detector sets.

Where the electric light mains are not grounded, attaching the antenna lead to only one of the two wires in the socket will not direct an electric current to the set, but where the mains are grounded there is danger that a current will shoot through the set, burning it out. Amateurs, therefore must proceed with the greatest care.

Mr. Shotwell suggested the possibility that the power house, in his case half a mile from his home, may act as a huge regenerative element picking up the messages and giving them radio amplification. In this case, he said, the electric light wire would simply conduct the waves, as in the case of Major-Gen. George O. Squier's wired wireless, to the receiving set. The electric light wires run underground and through the walls of the Shotwell apartment house, so that Mr. Shotwell cannot understand how it its that they act as a better aerial than the antenna he previously had on his roof.

Mr. Shotwell uses a Grebe CR6 set with radiotron detector and two stages of amplification.

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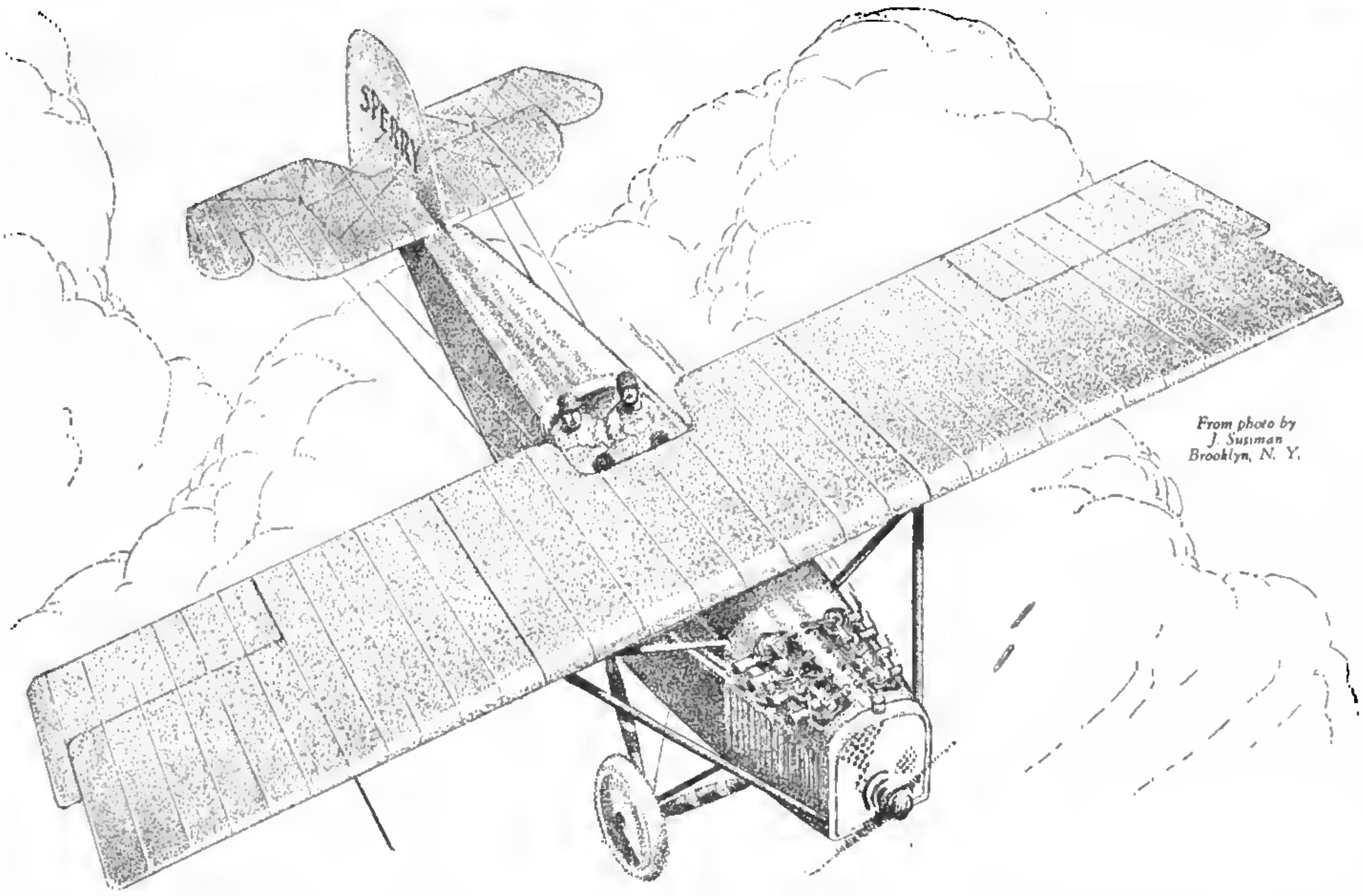

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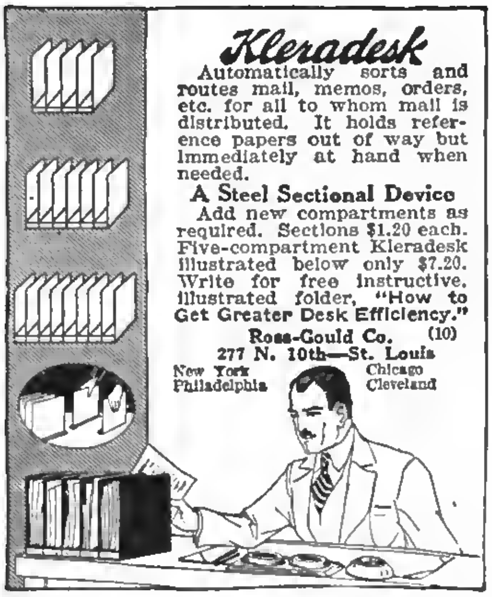

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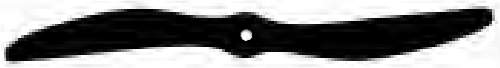

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Write in and state your requirements

(Concluded from page 177)

glass and automatically lighted in a certain order according to the direction of the wind. Such a system is possible, but very expensive.

The French organizations have tested another method for night landing. An oblong portion of the field is illuminated by a series of special searchlights in such a way that the major axis of the geometric figure formed by this illuminated portion lies in the direction of the wind. A red light placed beyond one end of this illuminated portion indicates the direction of landing, in order that all confusion may be avoided. The attached table gives the various signals employed on landing fields by day and by night.

3. *Signals for Foggy Weather.*—Since visual signals are useless in foggy weather, it is necessary to substitute sound or electro-magnetic signals. The use of the former is very limited, for the noise of the engines prevents their being heard on hoard. The latter are being investigated.

Conclusions

Regular and reliable aerial navigation is only rendered possible by the use of a suitable system of communications, signals and beacons along the air routes. These routes are nearly all international. The installation of their communications and beacons is therefore an international question and it is of the greatest importance for their development to have the various governments reach a complete agreement concerning the manner of establishing them. It is to be hoped that exchanges of views and discussions will increase between both private and public organizations for the development of aeronautics in the different countries. This can but help prepare the way for international agreements and hasten their realization.

Significance of signal	*Day Signals*	*Night Signals*		*Sound Signals*
		Lights	*Rockets*	
		Sent by the Aeroplanes		
Request for permission to land		Intermittent and indicative signals with one green lamp	Green rocket	
I am going to land		Short intermittent signals with navigation lights	Red rocket	
Distress	N. C. flag signals of the International code and distance signal	S.O.S. with any light	White rockets at short intervals	Continuous sound with any device
		Sent from the Ground		
Permission to land		Indicative and intermittent signals with green lights (green cross)	Green rocket	
Landing forbidden		Red lights (red cross)	Red rocket	
Turn to the left	Red barrier	Circle of red lights		
Turn to the right	White barrier	Circle of green lights		
Obstacles of less than 15 meters		Isolated red lights		
Obstacles of over 15 meters		3 red vertical lights 3 meters apart		
Entrance of the slip of a seaplane base		Row of 3 lights 1 white between 2 green		

(Translated by the National Advisory Committee for Aeronautics)

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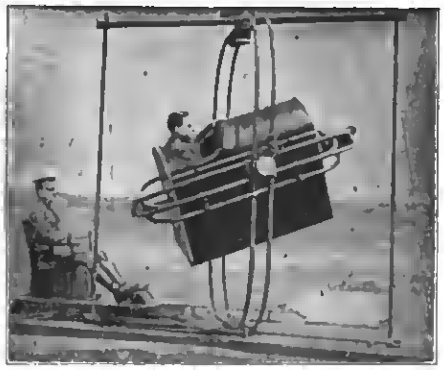

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Aeronautic events of great importance are pending and everyone who would be completely informed on the successive steps in the progress of these events should instruct us to place their names on our subscription list for the next year.

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(in various stages of completion)

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Sealed proposals for the purchase of unfinished ferrous and non-ferrous Aeronautical motor forgings and castings and other scrap metals will be received at the Material Disposal & Salvage Section, Office, Chief of Air Service, Room 2626, Munitions Bldg., Washington, D. C., until 3.00 P. M. (E.T.) April 25th, 1922.

Description of Forgings

These forgings and castings are in various stages of completion, and appertain principally to Liberty 12 Motors. There are also a small number of Hall Scott and Curtiss Motor parts. Detailed list of the parts can be seen at Room 2626, Munitions Building, Washington.

The approximate metallic analysis of these forgings is:

Steel	545,643 lbs.
Aluminum	204,274 lbs.
Bronze	8,850 lbs.

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The material is offered for sale "as is, where is" on a gross too basis for the steel and a poond basis for the alominom and bronze. The minimum bidding onit to be coosidered will be for the eotire quaotity of the varous kinds of metal offered.

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AERIAL AGE WEEKLY

VOL. 15, No. 9 | MAY 8, 1922 | 10 CENTS A COPY

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Spring Flying Meet—Rates in France to be Cut for Tourists—Maps and Navigation Methods

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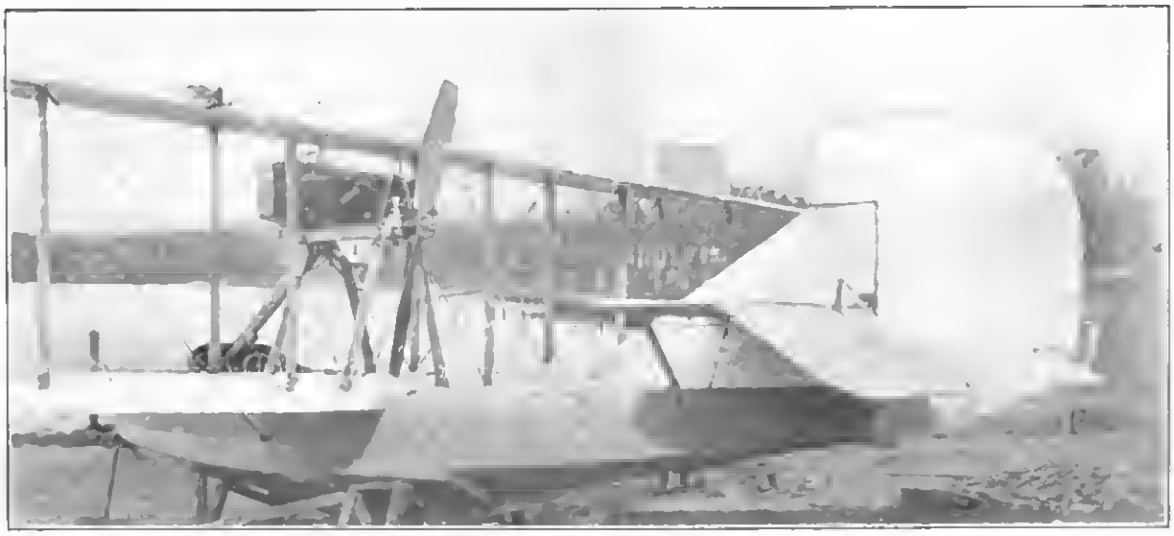

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May 8, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 9

TABLE OF CONTENTS

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With which Flying is consolidated

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Spring Flying Meet

A SPRING flying meeting held as a benefit for the Veterans' Mountain Camp attracted a crowd of more than 20,000 on April 30 to Curtiss Field, near Mineola, L. I. Foremost pilots in the country participated in events designed to demonstrate the fine points of the season's new models of aeroplanes. Twenty planes competed in the various races and tests. Between events pilots took spectators up for short "hops" around the field.

Otto H. Kahn, Assistant Postmaster General Paul Henderson, Major Gen. Mason H. Patrick, Chief of the United States Air Service, and Augustus Post, veteran balloonist, were among the spectators. The show was under the auspices of the Rotary Club of New York, assisted by the American Legion, the Aero Club of America, the Aeronautical Chamber of Commerce and the Curtiss Aeroplane and Motor Corporation, the last named, owners of the flying field.

Before the meet started Bert Acosta flew the Curtiss "Wildcat" at a speed of 208 miles an hour. The official world's speed record, established in France, is 203 miles an hour. As Acosta's feat was not officially recorded, it cannot be taken as a record.

There were ten contestants in an eight-mile flight over a triangular course. John Miller in a Curtiss Oriole won the first prize of $150, William Gillmore, second prize, $100, and A. Henrique, third, $50.

The spectators seemed to take the greatest interest in the performance of the Mummert, described as the smallest plane in the world. This plane has a wing spread of only eighteen feet and a length over all of twelve feet. Including the pilot, the total weight does not exceed 550 pounds, according to H. C. Mummert, the designer and builder. It was observed that only a short, thin pilot could sit in the tiny cockpit of the Mummert.

Contrasting with the Mummert was a huge Handley-Page twin-engined plane, seating twelve passengers in its enclosed fuselage. This plane, which was manoeuvred with seemingly remarkable ease, has a wing spread of ninety feet. During the afternoon the plane made several flights with invited guests as passengers.

One of the earlier Curtiss planes, which won the Gordon Bennett race in 1911, was flown at the meet and focussed attention on the strides that have been made in aeronautical development. The pilot, sitting on a bicycle-like seat, seemed suspended in the air. The manoeuvreability of this machine won the admiration of pilots about the field.

The postal air mail had six planes at the field for the inspection of the public. Assistant Postmaster Henderson, who is in charge of the air mail, announced that probably during this Summer aerial night flying mail service between New York and San Francisco would be established.

"The Air Mail Service cannot be improved without night flying," he said. "I am at present at work planning emergency landing fields across the continent at thirty-mile intervals. These fields will be lighted with beacons and flares, the latter turned on when a plane desires to land. The air mail planes will be equipped with radio directional finders and radio telephone."

Major Gen. Patrick, while watching the flying, called attention to the advance of the Orient in demonstrating the utility of the aeroplane in attack. He said what the Chinese had accomplished the latter part of the week was significant and prophetic of what would happen in wars of the future.

Rates in France to be Cut for Tourists

WITH the assurance that at least 300,000 Americans will cross Europe this season, most of whom will want to have as much time as possible in traveling across France, Belgium and Germany, aeroplane companies here are preparing to slash prices in an unprecedented battle for clients.

Already the companies crossing the Channel have lopped off 50 francs and are considering another decrease early next month which will bring the cost to the level of that of first class railway and steamship accommodations, with a saving of at least five hours between London and Paris.

Not only is this arrangement to apply to the regular schedules but the air station at Le Bourget is being equipped to accommodate at least 200 planes, which will be ready to leave in any direction at any hour, with pilots certified by the French Government.

The machines will be big enough to take ten passengers each in the great rush which is expected late in the summer, when trains are overcrowded and there are the alternatives of standing up all night or altering plans to visit the most cherished scenes.

Travelers generally, however, will find the railways anxious to give better service than last year. Although the rail tariff has not yet decreased, officials declare they are preparing for tourist traffic on a greater scale than ever before.

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THE NEWS OF THE WEEK

Captain of R-38 on Visit Here

Capt. Archibald H. Wann, who was in command of the giant British dirigible R-38, which was to have been known as the American ZR-2, when she fell into the Humber River at Hull, England, last August, carrying sixteen Americans to death, arrived recently on the Celtic.

Capt. Wann was accompanied by his brother, Major James Wann, also of the British Air Service. He was extremely reluctant to talk about the accident to the R-38, but admitted he had confidence in such dirigibles and looked forward to the day when they would be safe for travel.

"England hasn't given up building dirigibles," said Capt. Wann. "Her failure to build them now is due to lack of money and not lack of confidence. There must be accidents when experimenting."

He pointed out that Germany had fourteen very serious accidents before she successfully used the Zeppelin in the World War. Capt. Wann is here in an unofficial capacity. He and his brother came to this country to visit another member of his family, who is in business in this city.

Aviators' Ball in Airdrome Setting

The fourth Aviators' Ball was held at the Astor, New York City, April 24, and was largely attended, with a brilliant representation of society and officialdom from the State and New York National Guard. The ball was opened with military ceremonies, Mme. Eleanora de Cisneros singing the national anthem. Many high ranking army and navy officers and the presence of most of the allied aviators in uniform, with their decorations, marked the military and patriotic of the ball.

The ballroom of the Astor was transformed into an airdrome, somewhere in France, for the ball, and represented the landing field, with the national colors at one end and the air direction sleeve, a part of every airdrome's equipment, at the other. An electrical cloud effect and numerous miniature aeroplanes added to the realism of the background.

Many dinners preceded the function, among the dinner hostesses being Mrs. T. J. Oakley Rhinelander, Mrs. E. N. Breitung, Mrs. George D. Yeomans, Mrs. Malcomn Sloane, Mrs. Edwin Shattuck, Mrs. Harry Harkness Flagler, the Misses Barbara Brokaw and Dorothy Collins. Colonel Laurence L. Driggs, general Chairman of the ball, also entertained at dinner.

A feature of the evening was a pageant of the air presented under the direction of Francis Markoe, assisted by the Misses Dorothy Collins, Barbara Brokaw and Marjorie Cleveland. Those who took part in the pageant were the Misses Constance Banks, Elizabeth Andrade, Beatrice Batterman, Phyllis Batchellor, Alice Beadleston, Harriet Camac, Dolores Carillo, Nina Chatillon, Elizabeth Clarke, Florence Clendenin, Margaret Davison, Emily Dodge, Mrs. Henry Rogers Benjamin, Mrs. Howard Burdick and Mrs. Fal de Saint Phalle.

Incidentally professional dancers from current theatrical attractions appeared. Mlle. Stasia Ledowa, premiere danseuse of the Chicago Opera Company, danced "The Day of a Butterfly."

Mrs. Charles Dana Gibson was Chairman of the Patroness Committee. Among the patronesses were Mrs. Henry M. Alexander, Mrs. Cortlandt Field Bishop, Mrs. Robert Bacon, Mrs. John Barber, Mrs. Charles de Rham, Jr., Mrs. Newbold LeRoy Edgar, Mrs. Marshall Field, Mrs. Henry H. Flagler, Mrs. R. Horace Gallatin, Mrs. Jay Gould, Mrs. E. H. Harriman, Mrs. F. Burrall Hoffman, Mrs. Goodhue Livingston, Jr., Mrs. John Purroy Mitchel, Mrs. Theodore Roosevelt, Jr., Mrs. H. Rivington Pyne, Mrs. Herbert Shipman, Mrs. Henry Rogers Winthrop and Mrs. Charles C. Rumsey.

Monmouth Flying Meet

A flying meet will be held at Monmouth, Illinois, June 15 to 17th by the Monmouth Aero Club assisted by The Curtiss Iowa Air Craft Corporation of Fort Dodge, Iowa, owners and operators of the flying field at Monmouth. Major R. W. Schroeder will act as judge of the meet and will fly to Monmouth from Chicago with Mrs. Schroeder.

Many prominent fliers and manufacturers have accepted invitations to attend this meet and there is every assurance that it will be the biggest event of its kind ever held in Illinois outside of Chicago.

Major F. H. LaGuardia Addresses Aeronautical Executives

On Friday, April 21st, the Executives of the Aeronautical Companies in the vicinity of New York attended their seventh semi-monthly luncheon at the Café Boulevard.

Major LaGuardia was introduced to those present by the Chairman, Mr. R. R. Blythe who stated in his introduction that as the Major has been for years in political prominence and recently Colonel of the New York Aerial Policy, that his brilliant career was known to all.

"The future of Commercial Aviation is merely a question of time," pointed out Major LaGuardia. "There is no doubt in my mind but that we are on the verge of a very great development in Aeronautics; this, nevertheless, must come from within the industry itself. We cannot expect future large appropriations from the Government to sustain orders for planes and motors and thereby tide the industry over to better times. As times goes on the Government orders will be decreased, the aircraft budget will be cut to a minimum.

During the War when the Government took over the railroads there was a great deal of criticism for the Administration, but few people realized that the Government agreed to pay five per cent. interest on all the railroads' funded debt. In this, to a great extent, was the Government Railroad deficit increased. Now, just as the railroads were taken over in the past so will they be again in the future owing to the fact that slowly the interest on the railroad debt is mounting up and it is becoming increasingly harder to operate at a reasonable cost. When freights become excessive the Government will have to take a hand; the waterways of the United States will be utilized for slow freight, trains for regular freight and aircraft for express.

"Passenger carrying," said Major LaGuardia, "is the least remunerative of any form of transportation, it incurs greater expense, improved facilities, and more space than express or freight.

"It therefore, remains that those executives in the industry who are desirous of more rapid development to secure Government Mail Contracts and cater to fast express. Time and confidence will bring the passengers to our Central Air Depots."

The Portugal-Brazil Flight

Rio de Janeiro—The Portuguese aviators who were attempting a flight from Portugal to Brazil, will be unable to proceed in their hydro-aeroplane from St. Paul Rocks, a few hundred miles short of their goal on the American Continent, where they landed April 18 because of damage to their machine, according to a Havas dispatch from Pernambuco.

The message says their hydro-aeroplane was so badly damaged in effecting the landing that it is no longer usable. The aviators, however, expect to save the motor.

Another agency dispatch from the island of Fernando de Noronha, confirming the loss of the hydro-aeroplane, says the aviators are ready to resume their voyage and are confident of successfully completing it if the Government will furnish them with another machine.

Captains Coutinho and Sacadura started from Lisbon March 30 on their attempted flight to Brazil. Their first jump was to Las Palmas, in the Canary Islands, 710 miles, which they covered in seven and one-half hours. Delayed several days by bad weather, they finally hopped off from Gando Bay, in the Canaries, on the morning of April 5, for the Cape Verde Islands, some 800 miles distant, and reached St. Vincent, in the Cape Verdes, that afternoon.

There was further delay at these islands while favorable weather conditions were being awaited, but at 5:50 o'clock Tuesday morning, April 18, the airmen set off from Porto Praya, in the Cape Verdes, for St. Paul Rocks, about 900 miles distant, in mid-Atlantic. They reached their destination at the rocks at 8 o'clock Tuesday evening, but had a misadventure on landing. The dispatches Tuesday night, however, reported their machine was only slightly damaged.

From St. Paul Rocks the aviators intended flying to the islands of Fernando de Noronha, off the Brazilian coast, after replenishing their gas supply. The next leg of their flight would have brought them at Fernando de Noronha, within about 275 miles of Pernambuco, their intended destination.

The Aeroplane as a Time Saver in Business

One of San Francisco's most successful business merchants, Mr. James Otis, to whom time, in a very literal sense, means money, realizing the value of the aeroplane as a successful saver of silver seconds, substitutes for a high-powered roadster in which to travel from place to place on important business missions, his 2-passenger Ansaldo "Airster." Through the courtesy of Mr. Otis, several ladies of Crissy Field were treated to a "hop" in the Ansaldo recently. One or two of the intrepid aviatrices were seasoned aerial navigators—they had been up at least once or twice before! The Ansaldo "hop," however, provided the others with their initial aeroplane "thrill."

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The AIRCRAFT TRADE REVIEW

American Air Service Company Plans

Major Charles J. Glidden, President of the World's Boards of Aeronautical Commissioners, Inc., at the banquet of the Publicity Club at Springfield, Mass., said:

"After inspecting the landing fields—and possibilities of Springfield, that on account of its geographical position Springfield is bound to be a distributing point for Air Mail Merchandise and passengers to all parts of New England States to points in Vermont, New Hampshire, Eastern, Central and Northwestern Massachusetts points; also Maine and the North Eastern Provinces as far as New Brunswick and Newfoundland, and Canada from Montreal to Three Rivers and Quebec.

"The aeroplanes from New York will fly express to Springfield, where the merchandise will be transferred in hampers and the mail in sacks to planes covering the area above mentioned. Therefore it is very important that Springfield should keep close in touch with the aeronautical movement.

"The Committee on Investigation and Organization of the American Air Service Company to be incorporated to operate a line from New York to Chicago and the Pacific Coast are making splendid progress. This committee of which I have the honor to be Chairman was appointed at the Biltmore Hotel meeting February 11th. The meeting was addressed by Mr. Milton A. Stone of your City and Chairman of the World's Board of Aeronautical Commissioners, Inc., for Massachusetts, Congressman Steenerson, Chairman Committee on Post Offices and Post Roads, special representatives sent to the meeting by the Postmaster General, Secretary of the Navy, and others.

"This line will be extended to Springfield, Boston and the Provinces, and we hope to start a daily test service within the next sixty days each way between New York and Chicago, carrying first, mail and merchandise, later passengers.

"The ships will fly at night, leaving Chicago and New York about midnight, arriving in the early morning. Bankers say this will save $100,000 daily in interest charges on bank clearings.

"Following the test flights, permanent service will be established between New York and Chicago. The test flights will then be put into operation between Chicago, San Francisco, Los Angeles, Seattle, New Orleans and other points."

General Theory of Thin Wing Sections

This report (No. 142) of the National Advisory Committee for Aeronautics by Max M. Munk deals with a new, simple method of calculating the air forces to which thin wings are subjected at small angles of attack, if their curvature is not too great. Two simple integrals are the result. They contain only the coordinates of the wing section. The first integral gives the angle of attack at which the lift of the wing is zero, the second integral gives the moment experienced by the wing when its angle is zero. The two constants thus obtained are sufficient to determine the lift and moment for any other angle of attack. This refers primarily to a two-dimensional flow in a non-viscous fluid. However, in combination with the theory of the aerodynamical induction, and with our empirical knowledge of the drag due to friction, the results are valuable for actual wings also. A particular result obtained is the calculation of the elevator effect. The following is an outline of the subject as treated in this report:

I. Introduction.
II. Calculation of the elevator effect.
III. General formula for any section.
IV. Examples of the zero angle.
V. Thin sections with upper and lower boundaries.
VI. The moment coefficient.
VII. Examples of the moment coefficient.
VIII. Table of the sections investigated.

A copy of Report No. 142 may be obtained upon request from the National Advisory Committee for Aeronautics.

Progress of Aeronautics in Congress

The Aeronautical Chamber of Commerce has prepared the following memorandum concerning the progress of aeronautic matters in Congress.

March 13, *Senate.*

Mr. McKellar introduces S. J. Res. 175 relative to the purchase of aircraft from any foreign nation, citizen, or corporation.

March 21, *House.*

Executive document 572, transmitting supplemental estimate of appropriation for the Navy department for the fiscal year ending June 30, 1923, for salaries: "Bureau of aeronautics" 56,010, as a substitute for the estimate contained in the Budget of $43,310, and for "care, custdoy, and operation of the naval petroleum reserves," $100,000 (H. Doc. No. 218); to the Comm. on appropriations.

March 22, *House.*

Mr. Larsen introduces into the record a letter from an attorney (H. W. Driscoll) to an aviator suggesting that he appoint him attorney to collect back pay made possible by a recent decision of the Court of Claims. The fee was to be one-third of the amount collected. For all the cases involved as a result of this decision, the lawyer would receive about $1,000,000 for his services on the basis of one-third of the amount collected.

March 24, *House.*

Army appropriation bill debated. The need of helium investigated and more extensive experimental work at McCook Field debated.

March 29, *Senate.*

Mr. Hurd in discussing the Naval Disarmament Treaty emphasizes that the day of the battleship is over and that the aeroplane is one of the new weapons of warfare.

April 3, *Senate.*

Mr. Walsh of Massachusetts introduces a Resolution (266) proposing the establishment of a school of aeronautics.

April 5, *Senate.*

Mr. Walsh's resolution (see above) read again and laid aside for more complete data.

April 6, *House.*

Mr. Steenerson (H. R. 11193) to encourage commercial aviation and authorizing the Postmaster-General to contract for air mail service and prescribing rates of transportation and postage thereon; to the Committee on the Post Office and Post Roads.

April 11, *House.*

Mr. Woodruff introduces a resolution authorizing a Committee to investigate war contracts and expenditures. Brings into the discussion the subject of aircraft contracts.

April 12, *House.*

In discussing the the navy bill (H. R. 11228) the question of the no. of personnel in the navy service was brought up. Mr. French believed there was no basis of comparison between the British air force and the American as the British was an offensive force and ours is a defensive force.

April 18, *House.*

In discussing the Navy appropriation bill (H. R. 11228) the aviation appropriations were discussed. The bill calls for a total of $7,866,950. Mr. Hicks offered an amendment increasing the sum provided for overhauling planes from $5,475,000 to $7,093,000.

April 19, *House.*

Amendment of Mr. Hicks rejected (See above).

COMING AERONAUTICAL EVENTS

AMERICAN

May	—National Balloon Race.
Sept. 4 (*about*)	—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
Sept. 15 (*about*)	—Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)
Sept. 30	—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1 (*about*)	—Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Venice.
Aug. 6	—Gordon Bennett Balloon Race, Geneva, Switzerland.
Oct. 1	—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

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MAPS AND NAVIGATION METHODS

By A. DUVAL*

BEFORE undertaking any voyage, however short, the aerial navigator provides himself with the necessary maps. This is an easy matter in our country, where there is a wide choice among the various maps published by the Geographic Section of the Army, the Department of the Interior and the Aero Club.

When it is a question of a trip into a foreign country, the case is no longer the same. In some countries the only existing maps are incorrect or poorly edited, while in others they are comparable with ours, but French navigators, not being accustomed to their scales, nor to their colors, nor to their special manner of presentation, do not find them convenient. Reciprocally, foreigners experience the same inconvenience in using our maps. The most commonly used map is drawn on the scale of 1 : 200,000. This gives the most details of interest to the aviator, without taking too much paper. The 1 : 1,000,000 scale is useful for long voyages. It is always best to carry the corresponding maps on the 1 : 200,000 scale, for the aerial navigator sometimes has occasion to identify details not shown on the 1 : 1,000,000 map.

These two maps are not specially made for aviators. It seems therefore that the solution of the problem has progressed hardly any since Mr. Lallemand, member of the Institute, asked for the creation of aviation maps. This delay is explained by the fact that during the war the existing maps (1 : 200,000 of the Geographic Section of the Army, and 1 : 126,720 of the Ordnance Survey") were satisfactory to the aviators of the allies, who flew in restricted sectors and seldom made long voyages.

Now the requirements of civil aeronautics, the chief object of which is to make voyages are different and depend on aviation maps. This fact did not escape the attention of the experts who drew up the international agreement of October 13, 1919, containing regulations for aerial navigation. Annex F, of this agreement or convention, made provision for various international aviation maps, which the contracting countries will publish within a few years. Already three of the most enterprising nations have agreed on the details of execution, as we shall see further along.

Anyway, it is not out of place to call attention to the scope of the task undertaken, as well as to the value of the preliminary work accomplished since 1919. If the aviators, who are wanting aviation maps worthy of the name, had any idea of the work accomplished, their very natural impatience would be less prompt to manifest itself.

Under the respective designations of normal maps and general maps, the convention established two types of international aviation maps. In principle, they must be made according to the rules adopted for the 1: 1,000,000 map of the world, with the metric system of measurements. Each country, however, has the privilege to *add* its own units of measurement to the maps it publishes.

After discussion during the English-French-Belgian conferences of 1920 and 1921, the details of the conventional symbols were fixed. Since their exposition lies outside the scope of this article, we will confine ourselves to a general description of the two kinds of maps provided for.

General maps.—The general map is made according to Mercator's projection, one degree of longitude being represented by a length of three centimeters, which gives, in our latitude, an average scale of about 1 : 2,000,000. Each folio contains a complete number of sections of the map of the world on the 1 : 1,000,000 scale, which is generally nine for latitudes below 60°, six and even three for higher latitudes. Each side of each sheet covers 1° in latitude by 2° in longitude. There is a common portion on adjacent sheets, which facilitates the passage from one sheet to the next.

The relief is indicated by hypsometric tints supplemented by altimetric figures and, where there is occasion for it, by a slight shading. This method of representing the relief is in conformity with the 1 : 1,000,000 map of the world. It enables the aviator to choose instantly, without risk, the altitude of safety, in case of poor visibility. Any representation of relief, accomplished simply by means of shading and altitude figures, does not offer this advantage, since the navigator must read all the altitudes of a region in order to determine the altitude of safety. He runs the risk of overlooking that of the summit, against which he is in danger of crashing. The necessity of judging the altitude of the whole region led to the use of hypsometric colors for the general map. It is omitted on the normal maps, where each section bears on its margin the altitude of the highest point and of the lowest point in the region represented. The relief of the normal map is also shown by shading

Lastly, general maps are only provided for continents. Aviation maps are not necessary, in fact, for the oceans, for which the aeronaut will use marine maps based on Mercator's projection.

Normal maps.—These are published on the scale of 1 : 200,000. The kind of projection is not stipulated. This is because, on the one hand, the various projections differ but little on this scale and because, on the other hand, of the great advantage of being able to make use of much existing cartographic material.

Each section of the normal map embraces 1° in longitude and 1° in latitude. They will doubtless overlap one another by several kilometers. The relief is indicated by shading, supplemented by altimetric figures.

Miscellaneous maps.—The object of the convention was to create a set of identical aeronautic maps for the whole globe. Aside from these standard maps, the aerial navigator may use any others. Let us note, in passing, the 1 : 200,000 map of Capt. Hebrard and Lieut. Robbe, on which the roads stand out light against a dark background. The advantages of this method will be manifest, when night flights become common.

Maps are indispensable for the aviator. Their conception, however, depends on the methods employed in aerial navigation, which we will now endeavor to set forth.

"To navigate is to go from one point to another by the shortest and easiest route." This applies to both water and aircraft.

Aerial navigation, although freely accomplished in three dimensions (with certain restrictions in the vertical direction) is in all points comparable with maritime navigation. On the contrary, it is not comparable with the means of land transportation.

In fact; there are two methods of navigating an aircraft:

1. To fly with continuous reference to landmarks;*
2. To take a direct route by the compass, with only occasional reference to the ground for determining the position of the aircraft.

The former method, which is chronologically older, is still commonly employed. Although comprehensible in the beginnings of aviation, when only the pilot was on board and the voyages were of short duration, it is now an anachronism. To be compelled to follow a railway or a river is a loss of time. This method is, moreover, not very safe, for as soon as the pilot loses this "thread of Ariadne," he is lost. Errors have been frequent at cross-roads and junctions. Lastly, it is well to note the danger resulting from this practice. On a given aerial route, all the pilots would follow, in cloudy weather, exactly the same landmarks, thus creating great risk of collisions.

The second method, successfully employed on aeroplanes and airships by several crews, has stood the test for centuries in all navies. It is therefore no novelty, but merely an adaptation. By means of the compass, the pilot steers the aircraft in a constant direction with reference to the meridian. The path thus described is a loxodromic or rhumb line.

Hence, to steer by the compass is to describe a loxodromic curve. The pilot only needs to choose the one which connects his starting point with his destination, and then to make sure from time to time that he has not departed from it and, lastly, to verify his speed.

The use of the compass renders it possible to follow the most direct route between two points and especially to lose sight of land without inconvenience, for a certain length of time. At any instant, the navigator can determine his position by "dead reckoning," with the aid of his absolute speed and the time elapsed.

The accuracy of this method depends on the pilot's skill in using his compass and on the exactness of his knowledge of

*From "Premier Congrès International de la Navigation Aérienne," pp. 150-155, Paris, November, 1921.

*Some authors make a distinction between following a continuous reference line (highway or railroad) and flying from one reference point to another by comparing the ground and the map. This is a distinction without a difference, since in cloudy weather they lead to the same result, flight near the ground.

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the data employed, namely, the angle of the route followed and the absolute speed. The route angle is the angle formed with the meridian by the loxodromic trajectory described on the earth by the aircraft which is steered with the aid of the compass.

As often as possible, this dead reckoning will be verified by observations of terrestrial or celestial reference points, or other method (radiogoniometry, etc.).

Usually the wind causes the aeroplane to drift (uniformly, if the wind is regular). The angle between the axis of the aircraft called the course, and the route actually followed is the angle of drift. The pilot must therefore endeavor to determine the course to be adopted so that the drift will cause him to follow the loxodromic line traced on the map. Practically, for holding the aircraft on this course, the pilot must determine opposite what graduation of the compass rose he must hold the reference mark which indicates the position of the axis of the aeroplane. The compass course is obtained by correcting the given course by the angle of "variation." This variation is the algebraic sum of the magnetic declination (angle formed, at any given place, between the geographic and magnetic meridians) and the deflection caused by the iron of the aircraft, which affects the magnetized compass needle. The declination is always exactly known. As to the deflection, an endeavor should be made to eliminate this once for all by "compensation," the explanation of which lies outside the scope of the present article. It is a very simple and practical operation. When properly executed, the residual deflection is very small (1° to 2°) and the directive force of the compass remains constant for different courses.

The only difficulty encountered in following a loxodromic or rhumb line is therefore the determination of the angle of drift. By means of aerological soundings, this is easily determined before starting. The data for calculating the course then remain exact so long as the wind does not vary. If the wind is found to change, it becomes necessary to change the course steered or be driven off the true route. During the voyage, the navigator must employ one of the two following methods for determining the drift.

1. Determination, on the map, of two successive positions of the aircraft and of the exact route followed between these positions.

2. Instantaneous measurement of the drift by the observation of some point on the earth.

The first method utilizes what some call "navigation by observation," in which the navigator steers by calculation, which he rectifies by every observation made. He thus describes a series of loxodromic lines each one starting from the last point observed.

The second method of measuring the drift necessitates a brief view of the earth, without its being necessary, however, to identify any given reference point. It consists in measuring the angle formed by the apparent motion of the reference point and the course of the aircraft. This measurement can be made, even when the reference point does not pass directly under the aircraft. The S.T.Ae. (Technical Section of Aeronautics) drift-meter and the Le Prieur "navigraph" are based on this principle. Moreover, the results are faithfully preserved, which constitutes a great advantage, since two successive drift measurements with different courses give the magnitude and direction of the wind.

The absolute speed is measured: either by noting the time taken to traverse the distance between two observed points, which are shown on the map; or instantaneously by making measurements with reference to a single point, which does not need to be identified.

For utilizing the latter method, we may employ the navigraph, the S.T.Ae. drift-meter, or the Le Prieur "cinemograph."

In the S.T.Ae. drift-meter, there are two sighting wires, adjustable in altitude, which intercept a base of 500 km. on the ground. The navigator sights a reference point and measures with a chronograph the time of passage from one wire to the other. An abacus gives the absolute speed in km/hr.

In the Le Prieur cinemograph, the sighting is done with the aid of a slide carrying a stylus which traces a line on a paper moving vertically with a uniform speed. These combined uniform motions give a straight line, the inclination of which is a function of the altitude and of the speed. The errors due to changes in the trim of the aircraft are elminated by the fact of the graphic inscription.

In the navigraph, the absolute speed is obtained by the automatic production of the triangle of velocities, of which the sides "air speed" and "wind" are known, as also the angle of drift.

Observation point.—This can be obtained by watching the ground. The navigator either identifies some reference point under him or determines his position with the aid of distant reference points.

When the ground is not visible, the observation point is found by observing the stars, according to methods similar to those employed at sea. Unfortunately, the mariner's sextant is not utilizable on aircraft and no other instrument has thus far afforded any practical solution of the problem. For want of an astronomical point, the aerial navigator can utilize radiogoniometry.

The preceding exposition shows that loxodromy is the basis of aerial navigation. The ideal map for aerial navigation is therefore the one on which all the loxodromes are represented by straight lines and their angles with the meridians. Only Mercator's projection will answer these requirements. Its use for general aeronautic maps is therefore fully justified.

As regards utilizable routes in aerial navigation, we have purposely omitted orthodromy (sailing on the arc of a great circle). The arc of a great circle is in fact the shortest way between any two points on the earth's surface and would therefore seem preferable to loxodromy. This advantage is, however, only theoretical, since for all points less than 1,000 km. (622 miles) the difference between the orthodrome and loxodrome is negligible (about 1/300). Now, the stops, the obligatory points for crossing frontiers, and natural obstacles impose an itinerary, whose sections rarely attain 1,000 km. These sections are therefore loxodromcs.

There remains the employment of orthodromy on very long trips. Here again flight on the arc of a great circle does not make good its promises. If the points of departure and arrival are on the same parallel of latitude, the vertex or culminating point of the curve is near the pole and hence climatic considerations prevent the utilization of the most important part of the ideal curve. If the points of departure and arrival are almost on the same meridian or near the equator, the orthodrome and loxodrome differ but little. It should be noted, moreover, that the only method for describing a great circle consists in resolving it into a series of successive loxodromes of about 1,000 km. which are followed by means of a compass.

The arc of a great circle therefore serves to determine an itinerary. There is no need of special maps for this purpose, since Mr. Favé, a member of the Institute, has invented a rapid and simple method of tracing the arc of a great circle on a Mercator map. The employment of the Favé abacus enables the aerial navigator to determine instantly and accurately the points through which an arc of a great circle passes by simply moving over the map a transparent sheet on which is traced a whole series of curves representing the projection of various great circles whose vertices are on any given meridian.

In conclusion, we may say that, on the one hand, the question of aeronautic maps is progressive and is following its normal course; while, on the other hand, the empirical methods of aerial navigation thus far employed are retrogressive, slow and dangerous and should be replaced by scientific methods of navigation, based on loxodromy and the use of the compass.

(Translated by the National Advisory Committee for Aeronautics.)

STANDARDIZATION AND AERODYNAMICS

By DR. TRIZ. RICHARD KATZMAYR

Aerodynamical Laboratory of the Technischen Hochschule of Wien, Austria

WITH reference to the suggestion made by W. Knight in the AERIAL AGE, of June 20, 1921, for calling a congress of representatives of aeronautical laboratories in Europe and in the United States in order to arrive at an international agreement on the subject of wind-tunnel experimental work and standardization of aerodynamical terms and symbols used in aeronautical technical works, I wish to express the point of view of both Prof. Triz. Richard Knoller and myself on this subject.

After the very interesting discussion in the AERIAL AGE, by Prof. Prandtl (Oct. 3, 1921), by Prof. Karman (Jan. 2d, 1922), by Col. Costanz, (Feb. 20th, 1922), by Mr. Margoulis (March 6th, 1922), and by Col. Verdugio (April 3d, 1922) of Mr. Knight's article on "Standardization and Aerodynamics", I think it is well to state the stand taken on this matter by our laboratory.

In the issue of AERIAL AGE, which appeared on October 3d, 1921, Prof. L. Prandtl insisted on the absolute necessity of

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having an airstream of great constancy and freedom from eddies if wind-tunnel experiments are to have any practical value, and showed how such an ideal airstream can be obtained in practice. As a matter of fact the wind-tunnel of the Aerodynamic Institute, at Göttingen happens to be one of the few that permit such excellent conditions, and it should not be difficult to build all future wind-tunnel installations to give equally good results, if Prof. Prandtl's carefully-prepared specifications be closely adhered to. In the great majority of existing laboratories the airstreams that can be obtained with present apparatus are all but even, yet it would be uneconomical and too radical to consign them to the scrap-heap forthwith for that reason.

It would be of great value, however, if it were possible to compare without further question results obtained upon similar models in different laboratories, and this is quite within present possibilities. It would only require the testing of a number of standard bodies (such as spheres, fusiforms and one or two aerofoils), for their aerodynamic characteristics in all the leading laboratories and to compare results. To insure accuracy and to prevent slight differences in the models that might affect their behavior under test, the same set of models should be used in each experiment, no matter where performed. The several results thus obtained could then be used to establish what we might call a "laboratory factor" or a constant which would express all those elements which are peculiar to the laboratory in question and which cannot be deduced mathematically, as turbulence, proportion of model to area of airstream and especially the influence of the means for fastening the model to the balance. It is not sufficient to test merely a sphere, as was suggested, as such investigations as have been made with wing models have given different results. At the present time a series of comparative tests is being made between the laboratories in Vienna and Göttingen and it is intended to send the models to all the other wind-tunnels in Germany to obtain a better basis for comparison. It would be advisable to have this matter taken up by an international committee so as to include all the leading European and American institutions.

Attention should be called to the fact that for practical purposes it is not always advisable to employ a current that is totally free from eddies, such a condition is never prevailing in free flight. The degree of turbulence in the Vienna wind-tunnel *happens* to be such that the results therein obtained can be adopted without further correction, and several comparisons of full-sized machines with their models (usually in 1:15 ratio) have shown a remarkable correlation of the actual flight performance with the results calculated from wind-tunnel tests. It was noticed that an increase in turbulence has the same effect as the increasing of $\frac{vi}{v}$, which fact is of importance to laboratories of small dimensions and comparatively slow air-speeds, which are thus enabled to give satisfactory results with lower cost of construction and maintenance. For purely *theoretical* measurements, however, an airstream without turbulence is essential.

Regarding the size of the models and the best airspeed to be used, it may be observed that the results obtained during the past 10 years in the Vienna laboratory with a standard aerofoil of 900 x 150 mm. and in an airstream of 18 meters per sec. have proven very satisfactory.

Of great importance is the correct fastening of the models in the airstream. They should be so secured that the flow around the model is not disturbed, and yet a very stiff and inflexible mounting is essential. At Vienna this is obtained by means of four wires and a stream-lined supporting rod 2.5 millimeters thick.

In AERIAL AGE, of October 3d, Prof. Prandtl commented upon the advantages of reducing the airspeed to the equivalent expression for height ($\frac{V^2 g}{2}$) as first proposed in 1914 by Prof. Knoller and adopted by all German laboratories since 1917. He also advocated the general introduction of absolute coefficients.

One of the most necessary tasks of such an international committee is the standardization of aerodynamic definitions and units. Without prejudice toward the labor of the future committee the most widely used expressions and their generally accepted meaning may be summarized here.

In Austria the following symbols hav been decided upon:

$p = \frac{V^2}{2} g$ = Velocity pressure, dynamic air pressure, head.

v = resultant velocity, flight speed in meters per second or feet per second.

V = the same in KM per hour or M. per hour.

F = Wing surface or wing area.

R = Resistance.

A = Lift.

W = Drift.

N = Normal force.

T = Tangent force.

${}^cR$, ${}^cA$, ${}^cW$ = Unit air resistance, unit lift, unit drift, or absolute coefficient of res., lift or drift.

e = Center of pressure.

M = Ne = Torque.

E = Ratio $\frac{W}{A}$

X = Angle of incidence.

The following is an exposition of the choice of the above symbols:

p stands for "velocity pressure", and is well nigh international (*p*ressure in English, *p*ression in French, *p*ressing in German) being derived from the common Latin root *p*remo (to push).

v and V for "velocity," derived from the Latin "velocitas."

F for surface, with reference to the English and French (sur)*f*ace and the German *f*läche, all of which are derived from "*f*acies".

R was chosen for "*r*esistance", a word identical in most languages; also stands for the German "*r*esultierende" (resultant).

Hitherto R was resolved into its components L (lift) and D (drift), corresponding to the French R_y and R_x and the German A and W, the assumption being that L is perpendicular and D parallel to the line of flight. To speak about "lift" in this sense, however, is not strictly correct, inasmuch as a strict interpretation of that word assumes a force that is vertical with respect to the horizon and is equal and opposite to gravity, which condition in actual flight is but seldom true. It would therefore be advisable to use another symbol in every language. Prof. Knoller proposes to replace "lift" by "shear"—as expressing more correctly the action of a force which is perpendicular to another force independently of the latter's direction in space. The word "shear" being an engineering term meaning a force acting perpendicularly to the grain of a given material (German for shear = "*s*chubkraft"). S would be a better symbol in spite of the fact that the corresponding French word is "cisaillement."

The present symbol for *d*rift or *d*rag could be retained, and the present German expression (rücktrieb) could be replaced by "*d*ruck", meaning to pull or pressure, and a mathematically more correct expression. D therefore fits all languages and should be retained. Another proposal made by the present writer would substitute Z and X for L and D. The advantage thereof lies in the internationally understood application and the fact that the resistance R is actually resolved into two components which are vertical only to each other and belong to a system of coördinates of which the X axis is parallel to the line of flight. The aerodynamic expert is already familiar with the practice of referring moments of stability to this system, the axes being assumed to be identical with the theoretical axes of the machine itself.

The symbols N for *n*ormal force and T for *t*angent force are internationally self evident and require no explanation.

As Mr. Knight has observed, the greatest difficulty is encountered with the expressions ${}^cR$, ${}^cA$, ${}^cW$. In Germany and Austria they stand for dimensionless or "absolute" coefficients, which are obtained by dividing the forces R, A, W by the area F and the pressure p, as given by the equations $R = {}^cR\,F\,p$, $A = {}^cA\,F\,p$, and $W = {}^cW\,F\,p$. To express these quantities as "unit forces" is better, it being generally easier to understand a mathematical formula when every factor stands for a definite and concrete entity rather than a purely philosophic concept. After all ${}^cR$, ${}^cA$, ${}^cW$ are "forces" in the accepted sense, for they express a weight in kilograms which would act on a one square meter of surface under a dynamic pressure of 1 millimeter hydrostatic pressure. To write with a small (^{c}) immediately conveys the impression that a *c*oefficient is expressed, and writing it *before* the symbol prevents misunderstanding with exponents. This method of writing instantly indicates what force the coefficient refers to and is therefore easier to read than either the English (k_L. k_D) the French (k_x, k_y) or the German (C_a, C_w) in all of which the stress is laid on the quantity as a "coefficient" and the force that it refers to is merely indicated by a small letter below. To avoid every mistake it should be noted that

$${}^cA = 200\ k_L = 1600\ k_y = C_a$$

In addition in Austria the following symbols have been accepted: ${}^sA$ for "specific lift" as per the expression $A = {}^sA p$ and ${}^rA$ for "reduced lift" as per the formula $A = {}^rA\ F$. These expressions have been found very useful. Of course the prefixes *s* and *r* have international significance in this respect.

(*Concluded on page* 206)

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THE BACKGROUND OF DETONATION

By STANWOOD W. SPARROW

A DETERMINATION of the relative merits of various fuels for use in high compression engines is the object of experiments being conducted at the Bureau of Standards for the National Advisory Committee of Aeronautics. Inasmuch as the tendency of a fuel to detonate often makes it unsuitable for such use, a consideration of the general subject of detonation has formed the initial step in this investigation. The purpose of this note is not to summarize the available information on the subject but to discuss a phase which seems to have received relatively little attention.

In most discussions of detonation attention has been focused on the rate or the nature of the combustion. Charge temperatures and pressures before combustion have been considered from the standpoint of their influence on this rate rather than from the standpoint of their influence on the temperatures and pressures after combustion. This does not imply that investigators have failed to appreciate this latter influence, but that they have thought of it as a sort of necessary background fixed by the compression ratio and so have turned their attention to a factor that could be altered, namely, the rate of combustion. It is believed, however, that a careful scrutiny of this "background" will throw considerable light on some of the results that have been obtained in detonation research and to this end the following discussion is devoted.

Fig. I, which presents results obtained from a one-cylinder engine, forms a convenient starting point. In this figure and throughout the paper, the presence or absence of detonation should be understood to mean the presence or absence of the metallic ringing sound characteristic of detonation.*

As indicated in the figure, detonation was only apparent at spark advances between 25° and 55° before center. More interesting is the fact that with this engine detonation only occurred when the explosion pressure as measured was somewhat greater than 450 pounds per square inch. From this, one would conclude that for a given engine the explosion pressure must exceed a definite value if detonation is to result. Such a conclusion is a natural consequence of the common belief that the sound which serves to identify detonation arises from a deflection or vibration of the combustion chamber walls. It seems logical, therefore, to consider such changes of engine condition as are known to affect detonation and to estimate the effect of such changes upon the explosion pressures.

Compression ratio deserves first attention as it is known to exert great influence upon the tendency of an engine to detonate. Accordingly, calculated explosion pressures for several compression ratios have been plotted in Fig. 2. These have been computed as though the entire charge were burned at top center with no heat loss. Obviously explosion pressures thus calculated should exceed those obtained in practice.

* For a discussion of quantitative methods of measuring detonation, see "Methods of Measuring Detonation in Engines," by Thomas Midgeley, Jr., and T. A. Boyd. Journal of the Society of Automotive Engineers, January, 1922.

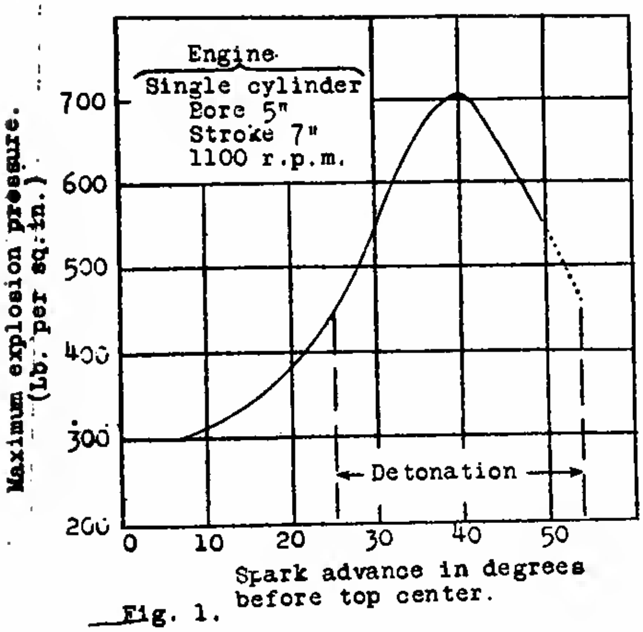

Fig. 1.

Nevertheless they form a satisfactory basis for comparison, provided actual rates of burning and heat dissipation are approximately the same for all the conditions compared. Moreover, ground for believing that this assumption is not far from the truth comes from the testimony of numerous investigators that they have obtained maximum power with nearly the same spark advances over a wide range of fuels* and compression ratios.

In calculating the values for Fig. 2, the following familiar relations have been employed:

$$P_2 = P_1 r^n$$
$$T_2 = T_1 r^{n-1}$$
$$M = T_3 - T_2$$
$$P_3 = P_2 \left(\frac{T_2 + M}{T_2} \right) = P_2 \left(1 + \frac{M}{T_2} \right)$$

where

r = ratio of compression and expansion.
P_1 = absolute pressure at beginning of compression stroke.
T_1 = absolute temperature at beginning of compression stroke.
P_2 = absolute pressure at end of compression stroke.
T_2 = absolute temperature at end of compression stroke.
M = increase in mixture temperature due to combustion.
T_3 = absolute temperature after combustion.
P_3 = absolute pressure after combustion.
n = exponent having experimental values ranging from 1.25 to 1.35.

In preparing Fig. 2, P_1 has been taken as 14.7 pounds per square inch, M as 2700°C and n as 1.3. In figuring T_1, the fresh charge has been assumed equal to the piston displacement in volume when at atmospheric pressure and at an absolute temperature of 320°C. In like manner the residual products of combustion have been assumed of a volume equal to the engine's clearance space when at atmospheric pressure and at an absolute temperature of 1273° C.** Some values thus calculated are tabulated below:

r	T_1	T_2	P_2	P_3	T_3
4	393°C	595°C	89	494	3295°C
5	376	610	119	645	3310
6	365	625	151	806	3325
7	358	643	185	960	3343
8	353	660	219	1115	3360

* All fuels give nearly the same maximum power at the same compression ratio.

** It should be remembered that the aim is a comparison rather than accurate determination of temperature and pressures. This justifies the omission of steps that otherwise would be essential. For example, the temperature increase produced by combustion has been taken as 2700°C for all compression ratios, although because of the smaller clearance volume of spent gas the amount of temperature rise should increase with the ratio (since less of the energy of combustion is expended in raising the temperature of the inert gas). An opposing tendency is the increase in specific heat that results from the higher compression temperatures of the higher compression ratios. The use of the same value of exhaust gas temperature for all ratios is open to similar

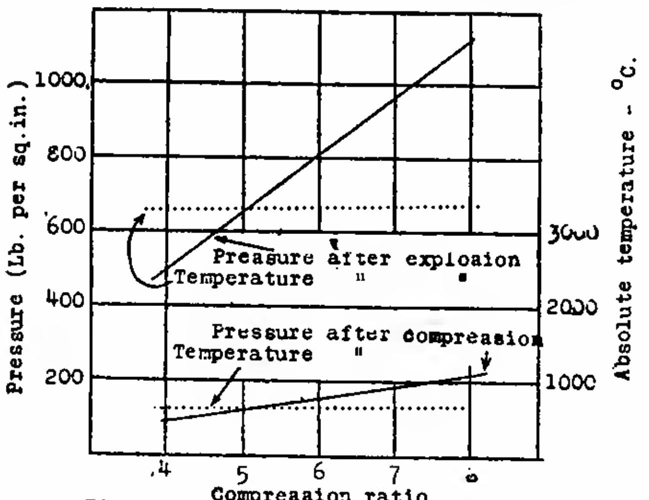

Fig. 2

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criticism. An increase in expansion ratio tends to lower this temperature, which effect is opposed by a decrease in heat loss due to the decrease in combustion chamber surface. These various tendencies have been considered but are not included in the calculations as their combined influence should affect the comparative values less than 5%.

Attention has been directed repeatedly to the many tendencies toward an increase in combustion rate with an increase in compression ratio. A smaller volume through which the flame must spread and a smaller proportion of inert gas are two of the factors emphasized. All such tendencies would increase the differences shown in Fig 2. The significant thing is that, neglecting all such possibilities, assuming no change in combuston rate, there would still be an increase in explosion pressure of over 125% produced by changing from a ratio of 4 to one of 8. This change in ratio would only increase the absolute temperature at the end of compression by 11% and the absolute temperature at the end of combustion by 2%. One is not surprised, therefore, that a well known British investigator concludes charge temperature to be of minor importance from a detonation standpoint.*

At this point it is well to consider Fig. 3, which presents some of the most interesting information that this investigator, Mr. Ricardo, has obtained from his variable compression engine. The figure shows data obtained by throttling the engine, at compression ratios above 4.8, to the point of detonation. The dotted line shows the I. M. E. P. obtained at full throttle with a non-detonating fuel. After operating at each ratio the compression pressure was measured with a gauge while the engine was driven by a motor at the same speed and throttle opening as before. The most striking lesson from this curve is that detonation occurs at very nearly the same compression *pressure* regardless of the compression *ratio*.

Inasmuch as this discussion is concerned with the relation of explosion pressures to detonation, an estimate of the probable explosion pressures for the conditions shown in this figure is in order. One might anticipate that the expansion of the gases after passing the throttle would cause an appreciable temperature drop. Calculation and experiment both show this effect to be negligible under the circumstances under consideration.* Another factor which is likely to influence the temperature at the beginning of compression is the proportion of exhaust gas present. This can be estimated rather closely by assuming that the weight of fresh charge at part throttle bears the same relation to the weight of charge at full throttle as the I. M. E. P. at part throttle bears to the I. M. E. P. obtained at full throttle with a non-detonating fuel.

* Harry R. Ricardo, "Transactions of the January, 1922, Meeting of the Society of Automotive Engineers." The conclusion quoted is expressed thus, "Our experiments appeared to show pretty clearly that detonation has very little connection with the temperature of compression, but is closely dependent upon the compression pressure."

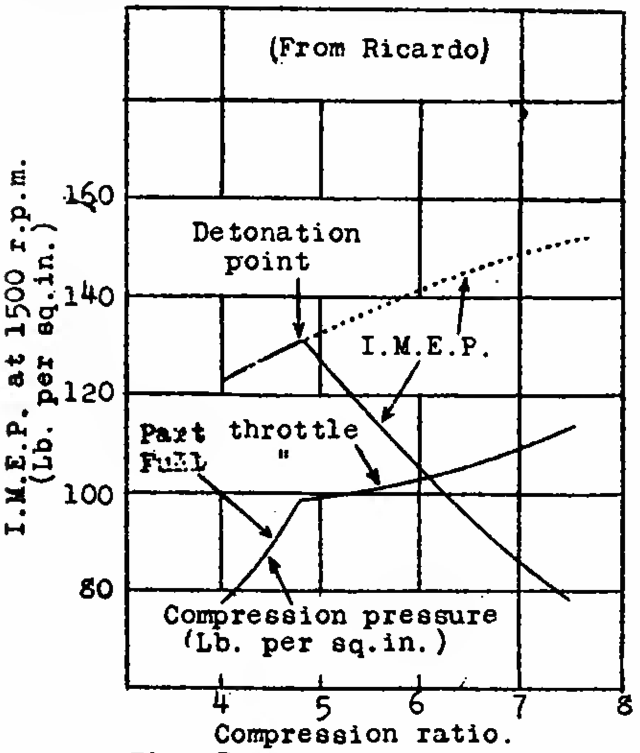

Fig. 3.

Actual experimental determinations of I. M. E. P. are given in the figure. Except for the use of the I. M. E. P. to estimate part throttle exhaust gas content, the method of calculation is the same as that used in obtaining Fig. 2. Although throttling an engine of fixed compression ratio tends to increase the proportion of exhaust gas to fresh charge, the calculations indicate that with the variable compression engine under the circumstances under discussion there is an accompanying decrease in clearance volume which neutralizes this effect. Thus over the range covered by the curves the exhaust gas expressed as a percentage of new charge varies less than 1. It follows that the temperature at the beginning of compression will remain nearly constant and values calculated on this basis are tabulated below:

r	T_1	T_2	T_3
4.8	388°C	620°C	3320°C
5.0	388	629	3329
5.5	388	648	3348
6.0	388	664	3364
6.5	388	680	3380
7.0	388	696	3396
7.5	388	710	3410

It will be recalled that the relation between explosion pressure and compression pressure is as follows: $\frac{P_3}{P_2} = 1 + \frac{M}{T_2}$.

An increase in compression ratio means an increase in T_2 and hence a decrease in the value of this ratio. For this reason a higher explosion pressure will be obtained from a low compression ratio engine at full throttl than from a high compression ratio engine throttled to the full load compression pressure of the low ratio. This fact may be stated from a slightly different angle in this fashion—to maintain a constant explosion pressure the compression pressure should increase slightly with increase in compression ratio.

* On p. 109, of Bulletin No. 19, of the Engineering Experiment Station of Ohio Stste University, Prof. Norman discusses the laws governing this drop in temperature and calculates the following values:

Gas velocity in feet per second	50	100	200	300
Temperature drop in degrees C	0.1	0.4	1.8	4.2

Tests at the Bureau of Standards showed no decrease in manifold temperature when the throttle of an aviation engine was closed while it was being motored with the fuel supply cut off.

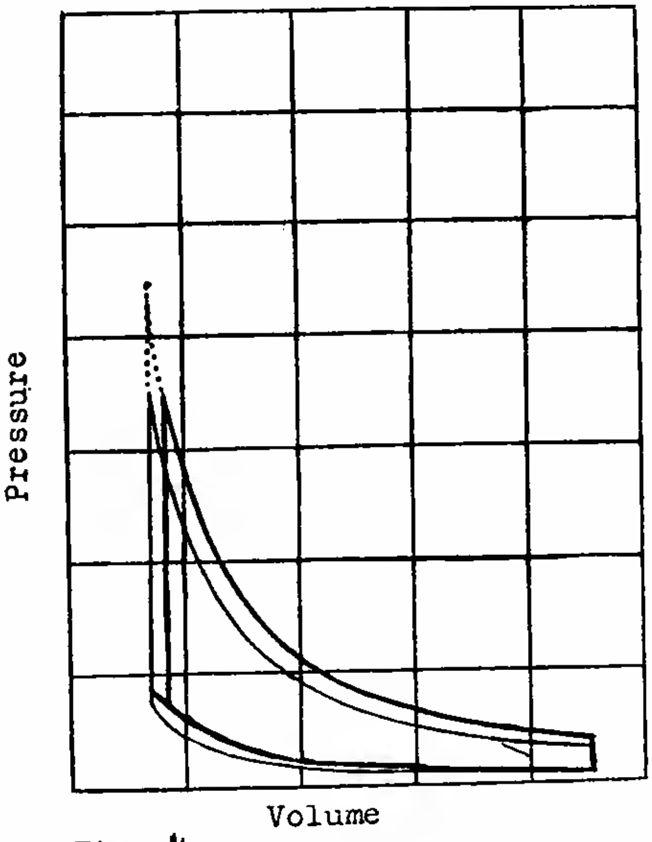

Fig. 4.

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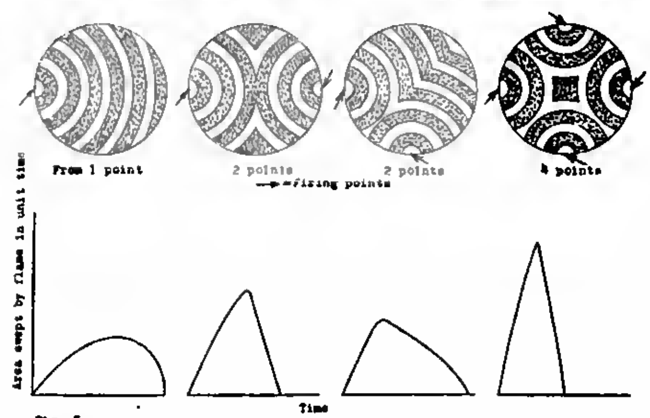

Fig. 5.

Explosion pressures as calculated for Fig. 3 are tabulated below:

r	P_2 (Absolute Pressure)	P_3
4.8	113	606
5.0	113.2	599
5.5	114.2	589
6.0	116.2	589
6.5	119.2	592
7.0	123.2	601
7.5	127.7	612

The maximum variation in explosion pressures is seen to be less than 4% and the deviation from the average pressure about 2%. When experiment has shown detonation to be constant under the conditions of Fig. 3, and calculations show explosion pressures to have been constant, there is reason for a deepening conviction in the close relationship of explosion pressures to detonation.*

Scavenging, that is to say, removing all or part of the spent gases from the clearance space, increases detonation. This fact has been taken as convincing proof of the great influence exerted by small proportions of exhaust gas on the rate of flame spread. Very probably this influence exists and operates as supposed. It is true, nevertheless, that the effect of scavenging on detonation can be explained partially at least by its influence on the explosion pressure. This influence is twofold. First of all, removing the hot exhaust gases from the clearance space of the engine means a lower temperature at the beginning and hence at the end of compression. Reverting again to the relation $\frac{P_3}{P_2} = 1 + \frac{M}{T_2}$, it is clear that lowering T_2, increases the ratio and thus the explosion pressure. This holds true if M, the increase in temperature resulting from combustion, does not decrease. But M should increase since the energy of the fuel is expended in heating a smaller mass of inert gas. This then is the second tendency toward increased explosion pressure and consequently detonation. Calculated explosion pressures show a probable increase of over 25% for a scavenged in comparison with an unscaveneged engine having a compression ratio of 4.

Another influence which vitally affects detonation is the ignition timing, the spark advance. As before, it is convenient to picture the charge burned at constant volume at a point in the stroke governed by the spark advance. This does not mean picturing the combustion as occurring at the same time as the spark but as always occurring at the same interval of time after the spark. The burning that takes place during this interval may be treated as the burning of a fuse that later fires the explosive. As shown when discussing the effect of compression ratio, the maximum explosion pressure should occur when the pressure prior to combustion is greatest. Since the charge is compressed most at top center the maximum explosion pressure should result from a spark so timed as to cause the actual combustion to take place at that part of the stroke and retarding the spark so that combustion comes later should decrease the explosion pressure. For the engine from which the pressure measurements of Fig. 1 were taken the estimated ratio of the explosion pressures obtained with combustion at various angles past top center to what would have resulted from combustion at top center are given below.

Degrees of crank angle after top center at which equivalent instantaneous combustion occurs.	Explosion pressure in % of the pressure when equivalent instantaneous combustion occurs at top center.
0	100
10	94
20	84
30	72
40	59
50	49

This demonstrates that very considerable differences in explosion pressure would be expected from a change in spark advance even if the rate of combustion remained the same. When there is superimposed the influence of a change in rate, it is not surprising to find differences of the magnitude shown in Fig. 1. The pressure at the time of explosion should be the same whether combustion takes place at a given angle before top center or after. With combustion before center, however, barring the heat loss, the subsequent compression of the burned gases will increase the pressure to a value in excess of that resulting from burning the charge at center. In practice it often happens that with an early spark the rate of heat loss exceeds the rate at which heat is produced by the compression of the burned charge so that the maximum pressure of the cycle is lower than with a less early spark. This accounts for the decreased pressures at the extreme spark advances of Fig. 1. Furthermore, it is not surprising that carbon-bisulphide, which preignites early in the stroke, does not detonate since the effect of preignition is that of a too early spark.*

The relative influence of spark advance and throttle opening on detonation is of considerable importance in connection with the use of high compression over-dimensioned engines. Such engines have too high a compression ratio to operate safely at sea level at full throttle with the spark advance that would give maximum power with a non-detonating fuel. Experiments at the Bureau have shown that for an emergency "take-off" such engines will develop more power if the spark is retarded to eliminate detonation than if the throttle is closed to produce the same effect.

Aside from its practical bearing on engine design, it is worth while to see whether the comparative influence of spark advance and throttle opening would be predicted from their influence on explosion pressures. The theoretical indicator cards of Fig. 4 will aid the comparison. In this figure the dotted line indicates the pressures at full throttle with a non-detonating fuel and a compression ratio of 6.5. The problem is to obtain from this engine the maximum power that is possible with a fuel which because of detonation cannot be used with an unthrottled engine having a compression ratio in excess of 5.5 (the volumetric efficiency is assumed the same for both ratios). If explosion pressure controls detonation, the problem resolves itself into so adjusting spark advance or throttle as to restrict the explosion pressure to the value obtained with an unthrottled engine of 5.5 ratio. Since the explosion pressure with a 5.5 ratio is about 82% of that with a 6.5 ratio, an engine having the latter ratio must be throttled to about 82% of full load. (Taking into consideration the modifying factors discussed in connection with Fig. 3, gives 85% as a closer value.) The full curve of the figure shows the probable pressure under this throttled condition.

The other alternative is to retard the spark so that combustion does not take place until the piston has traveled far enough on the down stroke for the pressure to have fallen to the maximum compression pressure with the 5.5 ratio. A full heavy line shows the pressures under this condition. Since the engine receives a full weight of charge, the power should be less than that obtained with the non-detonating fuel only because the ratio of expansion after combustion is 5.5 in contrast with 6.5 with the non-detonating fuel and the optimum spark advance. The air cycle efficiency** for a 5.5 ratio is 94% of that for a 6.5 ratio. Thus retarding the spark to

* On page 6 of "Recent Internal Combustion Engine Research," presented at the January, 1922, meeting of the Society of Automotive Engineers, Mr. Ricardo says: ". . . the tendency to detonate depends in effect upon the compression pressure not, as I supposed, because the pressure has any marked influence, but rather because in any actual engine the compression pressure is in itself a measure of the proportion of inert diluent present in the cylinder."

The reader will perceive that the author's interpretation of the data is somewhat at variance with Mr. Ricardo's. It is regrettable that the scope of the paper does not permit citing the many views of Mr. Ricardo with which he is in hearty accord. The use of Fig. 3 is but one indication of his belief in the accuracy and value of Mr. Ricardo's experimental determinations.

* In the Journal of the Society of Automotive Engineers, September, 1920, C. F. Kettering says: "Using carbon-bisulphide as a fuel, we get a genuine preignition. This fuel ignites very early and the pressure rises rapidly but it will not knock. Preignition will not necessarily cause a knock, because it may be that the pressures will not rise higher than normal."

** Air cycle efficiency $= 1 - \frac{1}{r^{n-1}}$ where n = 1.4 and r = expansion ratio.

(Concluded on page 206)

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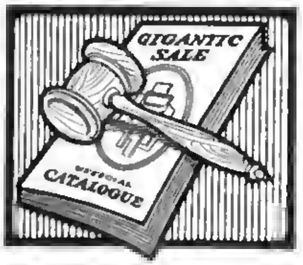

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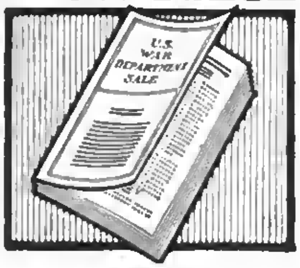

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avoid detonation requires a 6% decrease in power against the 15% sacrifice which throttling entails.

From all the evidence presented it appears that a close relationship exists between explosion pressures and detonation and that, having calculated the explosion pressures for an engine condition at which detonation occurs, for any other engine condition the probable presence or absence of detonation can be predicted from a calculation of the probable explosion pressure. It does not follow necessarily that the uniform explosion pressures as here calculated produce the sound of detonation. There is evidence that there are local pressures which exceed these average pressures and to which should be charged both the sound and destructive effects of detonation. The evidence does indicate that if local high pressures exist they are proportional to the average pressures as calculated, inasmuch as the latter have proved an accurate index of the presence or absence of detonation.

Emphasis, thus far, has been placed on conditions that influence detonations even with the rate of combustion unchanged. Better appreciated and no less important is the influence of a change in combustion rate with other conditions remaining constant. In fact, detonation research has confined itself largely to attempts to influence this rate. The goal is a slowing down of the final stages of combustion. It may be neither necessary nor desirable to decrease the average combustion rate. Tradition tells us that it was the "*last* straw" that brought disaster to the back of a camel and similarly, it is the *last* rise in pressure that brings ruin to the head of a piston. An illustration will show how this disastrous peak pressure may be avoided by a slight change in the combustion rate. For the first condition assume that the piston is at top center, that all the charge has been burned and that the charge temperature is 3350°C. Assume also that a temperature drop of 250°C results from the heat dissipation during the next 10° of crank motion. For the second condition let it be assumed that when the piston reaches top center sufficient charge has been burned to have produced a temperature of (3350 — 250)°C and that the remainder is burned during the next ten degrees of crank motion at such a rate that the heat input shall just offset the heat dissipation and the pressure and temperature at 10° past top center be approximately the same as in the first case. The ratio of the pressure in the latter case to that in the former is $\dfrac{3350 - 250}{3350}$ or 93%. The only difference in power that should result is that due to a loss in efficiency chargeable to the decreased expansion ratio of the portion of the charge burned in the ten degrees after center. Calculation shows the net loss to be less than two-tenths of one percent. In short, a decrease of 7% in maximum pressure is obtained at the expense of a decrease of two-tenths of one percent in power.

Fig. 5 indicates in a general way why differences in spark plug position and combustion chamber shape change the rate at which the charge is consumed. By means of the alternate light and dark areas the amount of surface swept by the flame from each spark plug in equal time intervals can be determined. The lower plots show total areas swept by flame in unit time plotted against time. In these figures the area under the curve at the left of any ordinate represents the total area swept by the flame up to that time. The upper flame spread diagrams are drawn as though the flame moved radially at a uniform linear rate. This assumption is admittedly false for the flame, at least in its initial stages, spreads at an accelerated rate. Moreover, in the engine it is not areas with which one is concerned but volumes and the problem is further complicated by the movement of one wall of the combustion chamber, namely, the piston head. Obviously, then there is no point in analyzing the figures to show which spark plug arrangement gives minimum detonation. Their sole aim is to show why a change in spark plug arrangement should make a difference in detonation.*

A discussion of the influence of changes in fuel characteristics upon detonation lies outside the province of this paper. Possibly the most hope of relief from detonation troubles lies in the ability to alter these characteristics, and much excellent work has been done in this field.**

Except in the case of the automobile engine the noise of detonation in itself is of no consequence. Detonation's seriousness lies in its high pressures and in the excessive heat loss which prevents the attainment of the power that would otherwise be possible. Most investigators have been made acquainted with this excessive heat dissipation by an increased loss to the jacket water whenever detonation has been present. In a preceding paragraph a comparison was made between the effect of burning all the charge at top center with a resultant temperature of 3350° C. and slightly retarding the rate of burning so that the maximum temperature did not exceed 3100° C. Radiation varies approximately as the fourth power of the absolute temperature and would at top center be 35% greater with the higher temperature. It seems clear that much of the power loss that accompanies detonation can be attributed to excessive heat dissipation arising from a condition approximating the one just mentioned.

Preignition and detonation are now generally conceded to be entirely independent phenomena. Preignition is unusual, caused by a hot spark plug electrode, by an exhaust valve or by a piston head and depends upon the ignition temperature of the fuel. Changes in the design of these members will do much to prevent this trouble. The important fact is that such changes will be necessary with an increase in compression ratio unless the fuel has been prepared to eliminate preignition as well as detonation. It may be mentioned in passing that overheating troubles are a more likely result of preignition than of detonation. This can be illustrated best by assuming an extreme case of preignition with the charge ignited as it enters the cylinder and all burned by the beginning of the compression stroke. It is conceivable that the rate of heat dissipation during this stroke should be such that at top center the same pressure and temperature would result as when, under normal operation, the bulk of the charge is burned at top center. Pressures and temperatures during expansion would be the same for both cases. For the compression stroke, however, the average temperature with preignition would have been in the neighborhood of 3000° C. in contrast with 500 °C. under normal operation.

As stated in the outset, this paper's sim has not been to present a complete picture of detonation but to consider several more or less independent features of the problem which have received comparatively little attention. Whether these features belong in the backgeound or foreground is immaterial so long as they are recognized as an essential part of the picture.

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* For a discussion of actual combustion chamber shapes and their influence upon detonation, see "Turbulence," by H. L. Horning, on page 579 of the Journal of the Society of Automotive Engineers, June, 1921.

** "Combustion of Fuels in Internal Combustion Engines," by C. F. Kettering, Journal of the Society of Automotive Engineers, September, 1920; "Combustion of Fuels in Internal Combustion Engines," by Thomas Midgely, Jr., Journal of the Society of Automotive Engineers, December, 1920.

(*Concluded from page* 200)

The symbol *e* to indicate the distance of the center of pressure from the upper aerofoil surface has been in use in Germany and Austria for over ten years with good results. In other countries this quantity is seldom made use of. Whether *e* is the best symbol for this expression is a matter that should be decided by the committee.

M as an expression for torque is a well known symbol in mechanics, and it is advisable to retain it for that reason. Mathematically $M = N \times e$ and since N is nearly equal to A the expression $M = A \times e$ can be safely used for approximations. In Austria the special symbol ${}^{a}M = A \times e$ has been adopted.

Just as we have units of force we can have a "unit of torque"—also an abstract coefficient. For its expression ${}^{c}M$ has been devised with its corollary ${}^{ca}M$. We can, therefore, write

$$M = {}^{c}M \times F \times p \times t \text{ and } {}^{a}M = {}^{ca}M \times F \times p \times t$$

in which "t" is the chord.

Σ expresses in Germany the ratio $\dfrac{W}{A}$ and χ the angle of incidence. Whether these symbols should be internationalized is fit subject for discussion.

Regarding the graphic representation of test results it may be observed that the Vienna laboratory conforms itself to the standards prevalent throughout Germany.

It would be very desirable to come to some international agreement regarding the unification and standardization of aerodynamical expressions, and we hope that Mr. Knight will succeed in eliminating such objections as still, perhaps, exist toward the satisfactory solution of this important matter.

Translator's Note—In his paper Dr. Katzmay speaks of $\Sigma \dfrac{W}{W}$ as indicating, that is $\dfrac{\text{drift}}{\text{lift}}$. I have retained this expression in the translation in spite of the apparent error. In Germany the lift drift relation is expressed as a fraction. Here is a matter which surely calls for standardization.

I cannot agree with the author that "shear" would be preferable to "lift". There is nothing in the latter word that presupposes (as he states) a direction opposed to gravity and a *lifting* force might easily be conceived acting at an angle to the absolute vertical. In an aeroplane "lift" resolves itself into a "shear" at wing hinges where the latter are fastened to the fuselage, but that is a mechanical condition which is no factor in wind-tunnel work.

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NAVAL and MILITARY AERONAUTICS

New Airship Class at Langley Field

Due to the fact that the last Airship Class at Langley Field, Va., was nearly wiped out as a result of the Roma tragedy, the next class is being pushed forward, and it is now expected that it will commence operations on April 24th. This class will be composed of ten officers. Every effort is being made to supply the present deficiency of airship pilots so that the tactical development of airships may be proceeded with.

The Fastest Airship in the United States

The loss of the "Roma" created quite a void in the big lighter-than-air hangar at Langley Field, Va., and, to compensate for the loss of the giant dirigible, an English "Mullion" type airship was inflated about three weeks ago and has since been operated quite extensively. It is being used for the training of cadets in the piloting of two-man control airships.

The "Mullion" type airship was developed by the British in 1918 for use as a short range coastal patrol ship. It is fitted with two 75 h. p. Rolls-Royce "Hawk" engines, mounted above the stem of a streamlined car and driving pusher screws. The envelope has a capacity of 100,000 cubic feet of buoyant gas, and measures 165 feet in length, 49 feet in height and 35 feet, 6 inches in diameter. While the theoretical full cruising speed is 57.5 miles per hour, the airship officers who have flown this ship at Langley Field state that it is the fastest airship in the United States today. On several occasions it is claimed that a speed in excess of 61 miles per hour has been achieved.

This ship is very trim and neat in appearance, and offers considerably less resistance to the wind on account of the construction of suspensions, and the shape of the bag itself. It has the customary two ballonets and trims very nicely. It is reported, however, that the directional controls do not function as decisively and promptly as would be desirable. This is no doubt due to the fact that there is no top tail surface. All directional stability is taken care of by a lower tail surface to which the rudder is attached, and this results in a slight amount of rolling. On altitude control this ship behaves excellently and promptly. The car is light and well designed. Four or five passengers can be carried, although she functions better with only four passengers.

Shortly after the Armistice the War Department purchased several of this type of airship. The first one was inflated at Langley Field in 1919, but was destroyed when the temporary hangar blew down. Since that time A, C and D type of ships have been operated for experimental purposes, and this is the first time a "Mullion" has been put in the air.

The "Mullion" is also called the "S. S. T.," which stands for "Submarine Scout Twin," being motored with two engines. This type of airship performed flights of considerable duration for the British Navy and were used for locating and bombing of submarines. Quite a few German submarines were destroyed through the agency of this airship.

Flying Cadets Complete Training

The entire class of flying cadets assigned to Mather Field, Mills, Calif., completed their flying training and will receive commissions in the Reserve Corps, viz:

James C. Ayers, Walter A. Archer, John M. Barnes, Donald M. Cornell, Paul M. Conner, Robert J. Clohecy, John R. Rand, Sidney C. DuBose, Clarence A. Gilbert, Lloyd L. Hefling, Clinton E. Herherger, Guy F. Hix, Theodore R. Howe, Max M. Sternberg, Iver Igelsrud, Andrew J. Marincik, Ive McKinney, John C. McGinn, Leo L. Mellon, Earl C. Pierce, Arthur L. Smith, Donald A. Templeman.

Of this class, Cadets Hefling, Igelsrud and Ayers took the examination for appointment as 2nd Lieutenants, Regular Army, at the Presidio of San Francisco. The results of their examinations have not yet been determined. By their behavior and application during their training they have each proven that they would be the sort of officers needed in the Air Service.

A Lecture on Meteorology

The command at Mather Field, Mills, Calif., was treated to an interesting lecture on forecasting, meteorology, aviation and sundry subjects, delivered by Mr. Thomas R. Reed, of the San Francisco Weather Bureau. Mr. Reed's work in meteorology has been wide and varied. Added to this knowledge is his experience as an aviator with the French and American forces during the war, making him an authority on the subject as applied to flying particularly. His talk was of absorbing interest to his audience, and the information gained will be of great assistance to each flyer.

Fast Time Between Kelly and Ellington Fields

A report from Ellington Field, Houston, Texas, is to the effect that, so far as known, the fastest cross-country flight between Ellington Field and Kelly Field was made by Lieut R. T. Aldworth in an MB3 on April 1st. The duration of the flight westward was one hour and 23 minutes (151 8 m. p. h.) while the return flight against a somewhat higher wind was made in one hour and fifty minutes (114.5 m. p. h.) The distance between these two stations is 210 miles.

Spads and MB3's at Ellington Field

The 1st Group (Pursuit) at Ellington Field is rapidly being equipped with Spad and MB3 planes. It is planned by the 15th of April to have enough MB3's assigned to the squadrons to equip each officer of the Group with a plane in preparation for the forthcoming annual tactical training operations to be conducted during the latter part of June.

Ready to Tackle Forestry Patrol

In the event Forestry patrol is authorized for this season, there is not a man in the 91st Squadron at Crissy Field who will not be eager for this duty—which, by the way, is not strange, considering their phenomenal ability to make "smokes" disappear. The Squadron's radio department will be ready. Eight enlisted men have been enrolled in the Signal Corps Radio School being conducted at the Presidio, where they will receive a thorough course in operation and maintenance of radio. Two experienced radio operators are now on duty with the Post Radio Department, and the ships of the 91st are rapidly being equipped with newly overhauled equipment. The pilots and observers are receiving practical instruction by being required to work with the home station while on flights.

A New Hospital Aeroplane

The JN6HG aeroplane, which was remodeled at the Fairfield, O., Air Intermediate Depot into a hospital ship, has been completed and, as soon as weather conditions permit, it will be flight tested. From all reports, this is the first aeroplane of this type that has ever been manufactured. A special litter, constructed in the fuselage and easily accessible by swinging lids, makes a very desirable aeroplane for the purpose of transporting injured persons. The physican or attendant is provided with a cockpit immediately in front of the litter and just back of the pilot's cockpit facing the tail surfaces. It is so situated that at all times the physician or attendant is able to observe the patient through a window which is cut in the fuselage. This type of ambulance aeroplane is a decided step forward in transporting injured persons by aeroplane.

Crissy Field Notes

On March 27th Master Sergeant William F. Hohorst and his seven "go-getters" returned to Crissy Field from their two weeks' recruiting trip, which has carried them through Healdsburg, Santa Rosa and Petaluma, at which latter place they established recruiting headquarters. Seven recruits have been added to the ranks of the Air Service as a result of this trip, and Sergeant Hohorst reports that were it not for the lack of transportation funds, this number could have been more than doubled. The eager interest and keen desire to join the Air Service manifested by the majority of prospective recruits approached by the men from Crissy Field, wavered, waned and finally resolved into inaction because of the lack of the necessary supply of "filthy lucre" to transport them to Crissy Field.

The national magnet at the present time seems to be Radio, which is rapidly drawing all men unto it. In its efforts to meet the demands of the thousands of radio "fans" in the Bay district, the University of California Extension Division requested the co-operation of Crissy Field, with the result that on Friday of last week Mr. Allen Smith, an Air Service Reserve Officer, who is at present connected with the University of California, announced from a Crissy Field ship in which was installed an SCR-68 telephone set, a course of lectures on radio to be delivered in San Francisco by Mr. Herbert E. M. Metcalf, a radio expert, formerly connected with the Air Service. Judging from the enthusiastic attendance at Mr. Metcalf's lectures, Mr. Smith's announcement was a "sho' nuf" "heavenly" message.

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FOREIGN NEWS

London Papers on Paris Breakfast Table

With this week most of the London papers will be carried by air and will be available in Paris between 9 and 10 a. m., under arrangements made by Messrs. Hachette. Excellent!

Air Mail to Denmark

We understand that arrangements have been made for inaugurating, this month, an air mail service between Rotterdam and Copenhagen. The company which is to undertake the new service is stated to be Danish, although it is intended to use British machines and pilots. The plan is to have machines leaving Rotterdam in the morning, after the arrival of the night boat from London, and it is expected that they will be able to reach Copenhagen shortly after noon, so that the mails should be distributed early in the afternoon in Copenhagen. In the opposite direction machines will leave Copenhagen at 3 p. m., and will reach Rotterdam in time to connect with the night boat to London. Thus, instead of taking 72 hours, the mails between London and Copenhagen should do the journey in about 24 hours.

New British Empire Air Service Plan

Very considerable interest has been aroused by the announcement of the scheme for the formation of a company to establish an airship mail and passenger service to India and Australia. At the moment of writing, the decision of the Air Council in the mtater has not been made public, consequently it is not known whether this scheme, which calls for no capital investment by the Government, but only a contingent liability in the form of a State guarantee of interest of £91,000 per annum, will mature. The proposal has the backing of Vickers, Ltd., and of the Shell group, and the details of the scheme were explained at a private meeting at Caxton Hall, on March 30, by Commander C. Dennis Burney. Mr. A. H. Ashbolt, Agent-General for Tasmania, who has long been one of the stoutest advocates of Imperial airship services, presided, and Major G. H. Scott explained certain technical considerations. If the scheme meets with Government approval, it will presumably mean that existing airships will not be handed over to the Disposals Board.

Briefly, the scheme submitted by Commander Burney to the Air Ministry is as follows: The company's capital of £4,000,000 would be made up of £1,800,000 in ordinary shares, and £2,200,000 in debentures, subject to the Government arranging, by means of a subsidy, a guarantee of dividend and interest for a period of years. On ordinary shares a 6 per cent. dividend (free of income-tax) would be guaranteed for 10 years, and the debentures would carry 4½ per cent. interest (free of income-tax) until redemption. It is proposed that £1,200,000 ordinary shares and £2,200,000 debentures should be issued forthwith, leaving £600,000 ordinary shares unissued.

Of this share capital, Messrs. Vickers, Ltd., have undertaken to subscribe for 100,000 shares at par and the Shell group for 100,000 ordinary shares or debentures at par. Both companies will give full technical assistance. It is stipulated that the Government shall transfer to the company free of all airships, airship material, and airship bases—such as Pulham, Cardington, and Howden, and will supply wireless telegraphy and meteorological services.

The total contingent subsidy per annum in the form of a guarantee of dividend on the ordinary shares and interest on the debentures (on the capital now proposed to be issued) would be:—On £1,200,000 ordinary shares, £72,000 for 10 years; on £2,200,000 debentures, £99,000 until redemption, divided as follows:—British, £91,000 per annum; Australia, £40,000; and India, £40,000. These dividend and interest payments would cease as soon as the profits from the company were sufficient to pay them. It is suggested that no dividend or interest should be payable until the middle of 1923, and accordingly the coming Budgets will be unaffected. ?

The program of development would be divided into two stages—(a) a bi-weekly service to India; (b) an alternate day service to India, with a weekly extension to Australia. Capital would thus be conserved until the necessary experience has been obtained, to render the service efficient on the first stage, before expanding to the second stage. Commander Dennis Burney asks that until time has been given for consideration of this offer no airship or airship material should be broken up or otherwise disposed.

It is estimated that, unless the public take to airship travel very rapidly, there will be a loss on running expenses for the first two years. During this period nothing will be earned to write off depreciation charges, but, on the other hand, experience will give rise to large improvements in the design of airships, and consequently the airships originally constructed by the company will become obsolete with more than normal rapidity. The cost of this will be about £750,000, and it is suggested that when the profits have reached such a figure as to relieve the Government from their guarantee of dividend upon the ordinary shares, and the company can show to the satisfaction of the Treasury that it has established the business on a commercial basis, the Government will refund to the company the £750,000.

Estimates of expenditure and revenue were also submitted. They provide for the building of five new airships (the present fleet will be used for training and for short journeys only). The new ships will be much on the lines of the "LZ125," so far as size is concerned, with a capacity of 3,800,000 cubic ft. On a bi-weekly service to India it is believed that there would be a return of £372,000 per annum, after paying all costs and depreciation charges. Details were also given of a proposed extension to Australia. The sum available for ordinary shares is estimated at £240,000 per annum.

For the first year of full service it has been assumed that receipts will only equal one-third of the running costs, or £130,000 as against a total earning capacity of £1,482,200, and for the second year total receipts of £260,000. It has been further assumed in the computation of dividends that when the service is in full working order yearly earning of £1,037,000, against the total of £1,482,200, will be obtained.

The airships to be used would have a maximum speed of 70 knots, and it is thought that an average speed of 55 knots could be maintained. It is proposed to establish bases with mooring masts *en route*, and allowing six hours at each, the following time-table is estimated:

Bombay	5½ days	(now 17 days).
Rangoon	7½ "	(now 21 to 22 days).
Hong-Kong ...	8½ "	(now 4 to 5 weeks).
Australia	11½ "	(now 4 to 5 weeks).

To Advertise Air Travelling

A new scheme has been devised by the Lep Aerial Travel Bureau to display to prospective London air passengers the advantages of travelling to the Continent by air. A small daylight cinema of a new type has been erected in the bureau in Piccadilly Circus, and films depicting the Customs examination, start from the aerodrome, scens *en route*, etc.. etc., are shown. while an official explains the film and points out the benefits to be obtained by using the newest method of travel.

Commercial Aviation in Germany

At least ten aviation companies are operating lines in Germany, says Economist Consul Parmelee, Berlin, in a report to the Department of Commerce. The 1921 returns of seven of these (data for the others not being available) show a total of 1,653,053 kilometers or 1,033,158 miles of flight, the transportation of 6,182 passengers, and 30,713 metric tons of mail and baggage. One company, the Deutsche Luft-Reederei, carried almost half of the passengers and three-fifths of the mail and baggage in flights totalling 346,826 miles.

The Deutsche Luft-Reederei has announced new routes to be opened to Prague in Czechoslovakia and to Moscow by way of Koenigsberg and Wytebok.

The German Government grants a mail subsidy of 10 marks per kilometer on routes up to 300 kilometers and 11 marks for routes above 300 kilometers, provided time tables are strictly adhered to, and provided mail up to 100 kilograms per flight is conveyed free of charge. Payment is provided for overweight.

Companies are entitled to subsidy if they can prove a minimum record of 20,000 kilometers within a year. Payment of the total subsidy is dependent on at least 80 per cent. punctuality per month. Ten per cent is deducted for each 5 per cent. loss of punctuality. After April 1, 1922, only those companies are entitled to a subsidy who can prove that for every three military machines used they have purchased one of modern type.

As the subsidy is limited, the regular postal air traffic is to be suspended or limited from November 1 to March 31.

Owing partly to weather conditions, it has not yet been attempted to operate regular services the year round. The cessation during the winter months is said to be due, in part, also, to the necessity of repairing the limited number of aeroplanes which have so far been available.

Article 202 of the Versailles Treaty and the subsequent London Ultimatum of May 5, 1921, have prohibited Germany either from manufacturing or importing aircraft. The note of February 1, 1922, however, has set May 5, 1922, as the date upon which resumption of construction, import and export of civil aircraft accessories will be permitted. Allied supervision of civil aviation in Germany will continue after May 5, 1922, though the precise form which this supervision will take is not yet known.

Pretoria Experiment

The Meteorological Office at Pretoria is about to liberate balloons to which instruments for determining the temperature and pressure of the air at various heights are attached. The balloon is quite free. It ascends until it bursts and then acts as a parachute to the falling instrument which is secured to a "spider" constructed of three springs of bamboo about 3 feet 6 inches in length. At the six ends of the bamboo small red flags are attached and the spider is so arranged that, however it falls, three flags lie well above the ground to attract the attention of anyone passing in the vicinity. The success of the experiment depends on the recovery of the instrument and the Government offers a reward of £1 to the finder, provided he carries out the instructions on the label attached to it. The label reads: "Investigation of Upper Air. This instrument is a delicate meteorological apparatus. Pull out the piece of red string with match end attached and then convey carefully to nearest Magistrate. If the instrument has not been tampered with you will receive £1 reward."

Rome-Tripoli Service

To establish more rapid communications between Italy and Tripolitania, the Secretary of the Colonies, Hon. Girardini, is endeavoring to organize an aerial mail service from Rome to Tripoli that may eventually be used also for the transportation of passengers. For this purpose the Superior Command of Aeronautics has granted the use of the airship Esperia (ex-Bodensee) to make its first flight, which will take place in the coming Spring. In the meantime, while they are completing certain works in order to prepare the aeroplane for her flight, her commandant, Major Valle, will go to Tripoli personally to make sure of a safe landing.

Palestine-Mesopotamia

The Palestine General Post Office has just announced the inauguration of a fortnightly mail service by aeroplane from Palestine to Mesopotamia, according to a report received by the Department of Commerce from Consul Southard at Jerusalem. There has been a military service over this route for some time, from Cairo via Palestine and Transjordania. This announcement merely opens the service to the public.

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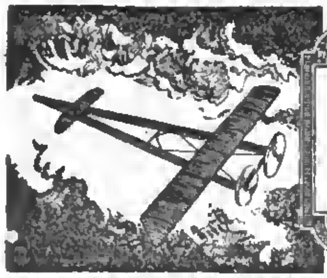
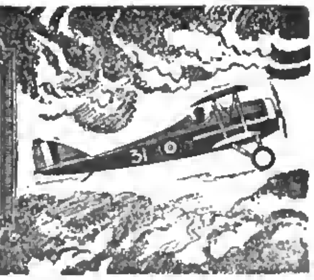


ELEMENTARY AERONAUTICS *and* MODEL NOTES



Elementary Aeronautics

Construction of the Navy Racer Model Trophy

BUILDERS of scale aeroplane models will be interested in the construction details of the miniature Curtiss-Navy model, recently presented to the Navy Department as a gift trophy by the Curtiss Aeroplane & Motor Corporation. The Curtiss Company designed and built the racing aeroplane in which Bert Acosta won the Pulitzer Trophy race at Omaha, on November 3d, last year. The successful flights of this plane created much enthusiasm among the naval officers responsible for its adoption by the Navy, and as a souvenir of the Omaha victory, the Curtiss Company had a special scale model constructed by its expert model builder.

Although many of the newspapers gave an account of the presentation, praising the fine appearance of the model, no mention was made of the actual construction and such information as desired by model builders. A representative of the Elementary Aeronautics page of AERIAL AGE interviewed the model expert who constructed the trophy, with the result that much intimate information was obtained concerning it.

All parts of the model were made and assembled by Mr. Thomas H. Birmingham, who is in charge of the Curtiss wind-tunnel model department. Mr. Birmingham has had considerable experience in building accurate scale models of steamships costing thousands of dollars. In the construction of model aeroplanes, whether for wind-tunnel tests or for display, he is able to carry out all the processes required for a model complete in every respect. For example, many model builders excel in wood-work, metal-work or finishing details, but it is unusual to find one whose work testifies his skill in all these branches, while at the same time forming a model so accurately to scale.

In designing this trophy model it was desired to keep the wing span close to ten inches. To accomplish this, all the measurements of the large machine were scaled down to 7-16ths of an inch to the foot. The outline of the model is accurately to scale within about 1-1,000th of an inch, which is extremely fine work for a model of this kind. Altho this is accurate, the regular scale models made by Mr. Birmingham are even closer to the exact scale measurements, being within 1-4,000ths of the precise figures reduced in scale. Wind-tunnel work requires such accuracy, for the slightest variation in true scale would make the tunnel tests of doubtful value.

Of course in such models no attempt is made to reproduce the weights to scale, and each part is formed of materials most suitable for forming the correct outlines. Solid silver was used wherever possible. The wings, which have the appearance of silver, were made of aluminum. The forming of these wings to the correct profile was a difficult job, requiring more than a week of work by hand.

The two N struts are of silver. At each end a small pin was left to project into the wing for fastening.

Tail surfaces are of aluminum, formed by hand filing. Braces to the fin and stabilizer, which on the real aeroplane are of steel, streamline wire are represented by fine silver wires on the model. Brace wires between the wings and on the undercarriage arc also simulated by silver wires.

Undercarriage V struts and axle streamline are of silver. The wheels were turned out on a lathe; the material used was brass, silver-plated. Tires were represented by a coating of heavy gray enamel.

The body was made of hardwood. It was divided into halves vertically through the centerline, and the portion at the pilot's cockpit hollowed out. A miniature instrument-board, seat and windshield are installed. The body is finished with four coats of gray coach varnish.

The two "Lamblin" radiators, located on the chassis struts, below the lower wing, proved to be the most difficult part to make. The real radiators themselves are of a complicated manufacture, and in reducing the parts in size, the complications were multiplied in proportion. Special moulds and dies were made to form the radiator shell, and the basket-like radiator tubes of silver-wire were arranged in their correct order by means of elaborate jigs.

At the rear of the body the steel leaf-spring tail skid is neatly arranged as on the real machine, with small overlapping spring leaves.

The base of the trophy is of turned ebony, polished. The pedestal shaft supporting the model is of silver, lathe-turned. A solid silver nameplate at the base is engraved with an inscription commemorating the winning flight of the Curtiss-Navy Racer, and bears the record of its speed over a "closed circuit" of 150 miles, which was covered in 52 minutes, 9 3-5 seconds, or at a speed averaging 176.7 miles an hour.

Insignias on the wings and rudder are of baked enamel, each color applied directly to the surface.

The propeller is made of maple, the grain of which, reduced at this scale, is in good proportion to the grain of oak, as used on the full-size machine. It is formed and finished with all the care and exactitude of real propellers.

A month of time was required to build the model and its actual construction cost was about four hundred dollars.

The Flight Association of Ottawa, Canada, Organized

Mr. Oswald Barry announces the organization of a new club, formed for the purpose of model experimentation. The club has been named The Flight Association of Ottawa, Canada, and Mr. Barry is its president, pro tem.

The Association is composed of willing workers, and the constitution is so drafted as to exclude those who are not seriously interested in model building. Some of the members are quite proficient in the work, having followed the model game for eight years.

A cordial invitation to membership is extended to all those residing in that section of Canada, and the earnest tyro is quite as welcome as the seasoned veteran.

Correspondence is invited from other clubs and from individual model builders. Mr. Barry's address is 117 Albert Street, Ottawa, Canada.

The Curtiss-Navy Racer Model presented as a souvenir to the Navy Department to commemorate the winning of the Pulitzer Race

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RADIO DIGEST

10,000 Radio Fans Hear Bride's Kiss in Aerial Wedding

A kiss struggled through the ether April 24 and 10,000 radio enthusiasts knew then that somewhere between Mineola, L. I., and Forty-second Street and Broadway, New York, 2,500 feet up in the air, Miss Sarah Cockefair and Albert P. Schlafke had been safely married.

Miss Cockefair, who is a nurse in Brooklyn Hospital, and Mr. Schlafke, who is physical director of the Veterans' Camp at Tupper Lake, decided that since they were going to be married anyway they might as well have as large an audience as possible.

A six-passenger Fokker was rigged up with a radio set. Bert Acosta agreed to pilot the ship. The Rev. Belvin Maynard, the "Flying Parson," was there to perform the ceremony. So the wedding party hopped off with Frank Daniels to attend to the radio, seven-year-old Louise Robb, winner of sixteen baby shows, as flower girl and George Weed to see that everything went properly.

The bride threw out her bridal bouquet of roses when she was 1,500 feet up and, when the plane was passing over College Point Lieutenant Maynard began the service. His questions and the responses could be heard plainly from an amplifier set up on the field and by all those who were listening in on their own radio sets.

The couple landed at 5:40 in a shower of rice.

Radio Equipment of the Ships "Paris" and "Lafayette"

Is described in a recent issue of *Radio-electricite*. On both steamess a 5-kilowatt tube transmitter has been installed with a wave range of between 2000 and 9000 meters. A 5-killowatt motor-generator set is used to produce the plate high tension for four rectifying and four oscillatory tubes, and the low-voltage current for the heating of the filament of these tubes. Both vessels are equipped with a radio rangefinder, or "radio goniometer," which, reduced to plain English, means a radio compass. A distance of 3400 kilometers has been covered safely by messages sent from the transmitter of the "Paris."

The Radio Industry

It is evident that the radio industry has expanded to undreamed of proportions within the past few months. It is not surprising, therefore, to learn that one concern expects to do a business of well over $50,000,000 this year, judging by the returns of the past few months. There is an ever-increasing demand for vacuum tubes; it is estimated that by this writing 75,000 tubes are being turned out a month, and that by the time this reaches the reader the production will probably exceed 100000 tubes per month. Authorities in and out of radio are of the opinion that the radio business as it is now developing is going to be greater than the phonographic industry, which has been doing a business in excess of $400,000,000 per year.

Efficiency of Radio Plants

In a recent issue of *The Electrician* there appears the following editorial comment, which offers sound food for thought: "Apart from the press stunts, of which wireless has been the victim (or conspirator), the thing that most strikes the observer of progress in this branch of electrical service is the enormous dispoportion between the hundreds of kilowatts utilized at the transmitting end and the few microwatts picked up at the receiver. No doubt this apparently inevitable state of affairs has had its influence upon those who have been engaged in the practical development of wireless, for it is only within recent years that any progress has been made in the rounding up and extermination of the losses which take place within the transmitting plant itself. The old spark transmitter had an efficiency in the neighborhood of 15 per cent, but it is only necessary to inspect the oil-cooling system of the high-frequency alternator, the water jacketing of the arc, or the red-hot anodes of the very latest transmitter, the 3-electrode valve, to realize that even present-day apparatus has far to go before it approaches the efficiencies now commonplace in low-frequency and direct-current work.

World-Wide Radio

Every leading nation is interested in establishing a system of world-wide radio. Germany had such a plan before the war, which had a distinctly military tendency rather than a purely commercial attempt to keep in touch with all countries, both far and near. Great Britain has had a world-wide radio plan for many years, and of late the subject has been very much in the forefront of British circles. It is understood that the present plan considers six principal centers between which reliable radio communication is required, namely—Great Britain, Canada, Australia, New Zealand, South Africa, and India. Geographical considerations suggested the postponement of Canada and New Zealand. Of the remaining four, Australia, South Africa, and India form an equilateral triangle about 5000 miles along each side, while England is about 6000 miles from South Africa, 5000 miles from India, and 10,000 miles from Australia. The United States has also a plan for world-wide radio, which is rapidly progressing towards realization.

Radio Link in Telegraphy

Experiments on substitution of a radio transmission link for the customary wire transmission lines on the commercial multiplex printing telegraph, have recently been carried on. Results are given of tests made between New York and Cliffwood, N. J., a distance of 25 miles. The usual outgoing signals from the printer were transmitted by wire to the radio room, where by means of a relay controlling the radio transmitter they were converted into radio signals. The received signals at Cliffwood actuated a polar relay and converted the radio signals back to wire signals which were relayed by wire back to the printed laboratory in New York. These tests showed that 180 words per minute could be satisfactorily sent, according to the *Journal of the Franklin Institute*.

WGY Heard 2,600 Miles

The wireless operator on the steamship Luckenbach has just sent word that on March 30, between the hours of 3:50 and 4:38 in the morning, while the ship was south of Panama in the Pacific at seven degrees north of the equator, he had been able to pick up a musical concert sent out from station WGY in Schenectady. This is by airline a distance of more than 2,600 miles and establishes a new record for the station.

The ship operator, W. W. Braire, reports the time he heard each selection, named each selection, and his letter bears a confirmation of the ship's location signed by the master of the vessel. His report checks up exactly with the log of the concert broadcasted that night.

Prior to the letter from the S. S. Luckenbach, the southermost point reached by the Schenectady station was Tela, Honduras. Richard B. Dudley, chief operator on the steamship Coppename, tied up in the port of Tela, reported that he has distinctly heard the program sent out from WGY on March 16. Other distant southern places which have reported hearing WGY are Santa Clara, Cuba and Mexico City.

Important Dates in Progress of Radio-Telephony

The following are the outstanding events in the development of radio-telephony, as compiled by Professor Philip R. Coursey. One of the most important of all, the invention of the vacuum tube, is omitted from the list, probably because it lies more in the province of sound than of pure radio. The events listed deal directly with the extension of range rather than of audibility.

1885—Experiments with the induction system were carried out by Sir William Preece at Newcastle-on-Tyne. A speaking range of 440 yards was obtained.

1894—Experiments with conduction system successful for distance of one and one-half miles across Loch Ness.

1887—The induction system was utilized in mines. Telephonic communications was established between the surface and subterranean galleries of Broomhill Colliery, 350 feet deep, by A. W. Heaviside.

1899—The conduction wireless telephone was installed between Skerries and Anglesea. Average distance between stations, three miles. A similar installation was also put into use between Rathlin Island and the mainland of Ireland. Range of speech communication, eight miles.

1900—Early experiments by R. A. Fessenden with a special high-speed commutator to obtain a rapid sparking rate. Speech transmitted by ether waves for about a mile, but articulation not very good.

1899-1900—Experiments made with A. F. Collins's electrostatic method were successful up to 200 feet range.

1902—The range of Collins's tests was extended to three miles. Articulation said to be perfect.

1902—E. Ruhmer, in the course of his extensive experiments with the photophone method, succeeded in telephoning over a distance of about four miles on Lake Wan-

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see, and subsequently at Kiel over a range of about twenty miles.

1906—Successful experiments carried out with a small high-frequency inductor alternator by R. A. Fessenden. Ranges up to about twenty miles obtained.

1906—Tests of art transmitters made by Telefunken Company between Nauen and Berlin—twenty miles.

1907—The range of Fessenden's tests was increased to about 100 miles, using improved H. F. alternators.

1908—Tests with the Colin-Jeance arc apparatus were made from the Eiffel Tower. A range of thirty miles obtained.

1908—Experiments by F. Majorana, using an arc oscillation generator with his liquid microphone, were carried out from Rome to a number of other stations—including ships. The range of successful speech communication was gradually extended from about thirty-five miles to 156 miles (Rome to Sardinia), then to 180 miles (Rome to Maddalena), and eventually to 300 miles (Rome to Sicily).

1908—V. Poulsen succeeded in transmitting speech over a distance of about 150 miles, using his arc transmitter.

1909—Successful tests of Poulsen type arcs between Milwaukee and Chicago (ninety miles).

1909—Ranges of speech communication up to seventy-five miles obtained with Colin-Jeance arc apparatus; subsequently increased to 100 miles between Toulon and a French cruiser, and ninety miles between Eiffel Tower and Dieppe.

1910—Experiments with H. P. Dwyer's arc gave perfect telephonic communication between San Francisco and Los Angeles—490 miles range.

1911—Range of speech communication from Nauen increased to about 350 miles (Nauen to Vienna).

1912—G. Vanni obtained a speech range of 600 miles between Rome and Tripoli, using the Moretti arc oscillation generator and the Vanni liquid microphone.

1913—Experiments at Nauen Station with 10,000-frequency alternator and static frequency raiser gave a range of 550 miles to Pola.

1913—Experiments at Nauen Station with 10,000-frequency alternator and static frequency raiser gave a range of 550 miles to Pola.

1913—Further experiments carried out with the induction system in mines demonstrated its special utility for such purposes. Communication was successfully established between the surface and a level 800 feet deep.

1914—The T. Y. K. arc system was first put into practical use at Toba.

1914—Successful speech communication from Brussels to Paris, 190 miles, using Moretti arc transmitter and Marzi's carbon powder microphone.

1914—Experiments carried out by G. Marconi with the oscillating valve transmitter on Italian war vessels. Ranges up to forty-five miles were obtained, using very limited power at the transmitter.

1915—Tests of oscillation valve transmitters gave successful communication between New York and California, 2,500 miles.

1915—The American Telephone and Telegraph Company carried out a series of very successful experimental tests with the valve type transmitters. Eventually the Atlantic was bridged between Arlington (Va., U. S. A.) and the Eiffel Tower, France, 3,800 miles, and good speech communication was also established between Arlington and Honolulu, a distance of close on 5,000 miles. Articulation was said to be faint, but very clear and recognizable.

1918—Considerable development of wireless telephone apparatus for communication with aircraft. Successful results obtained up to about 100 miles between aeroplanes in flight, and up to about 150 miles between aeroplanes and the ground.

1919—Successful wireless telephone communication established between the British Isles and Canada by special valve apparatus developed by the Marconi Company.

Business Firms Use Radiophone

The farmers in the Middle West for some time past have been receiving their weather and crop reports over the wireless telephone, broadcasted by the Government. Now enters the New York business man who sees a step forward in the adoption of the wireless telephone for general business.

Kaye & Einstein, manufacturing furriers, have installed a wireless telephone receiving station, which is connected with each of their nine selling booths A customer in these booths can pick up a receiver at any time, and listen to market reports, news of the day, crop and weather conditions throughout the country, financial reports, or the machine can be adjusted so that he will receive the music of a concert to soothe his frayed nerves. The machine has an amplifier connection with the factory, so that the working people may receive music and entertainment during working hours. The outfit is a very powerful one and will pick up messages from Pittsburgh, Chicago and points from a greater distance.

Built-in Vernier Best

If the very best is desired in a set that employs variable condensers for tuning, get condensers that have verniers built in. These are two-plate condensers, mounted directly on the main shaft and controlled by a separate arm. Rough adjustments are made on the big condensers, and very fine regulation is made with the verniers. The latter, before being touched, should be kept in half way, so that adjustments can be made either way, as necessary.

Grid Leak Important

Too much emphasis cannot be laid on the importance of the necessity of the right value of the grid leak. If it is not correct the set will howl unmercifully. Do not buy grid condensers with the leaks already built in. Buy a separate grid condenser, and either make or buy a leak that can be varied easily, such as the pencil line type. If the set does howl, try rubbing out some of the lines, and if the set doesn't work the way you think it should, try rubbing some more on.

New Regulations Use Radio to Aid Seaplane Fliers

Seafaring aeroplanes will be as safe as a chair at the opera if all the new regulations announced by Secretary of the Navy Denby are strictly enforced.

The regulations provide that all aeroplanes that make long passages be equipped with radio sets of sufficient strength to communicate with a ship or station at the near end of the passage. Machines will be required to go in pairs in all cases where a forced landing in a locality where any difficulty in finding a place of landing for the machine might be encountered. Even if a 'plane is equipped with a satisfactory radio set, it may fly so near to the ground in inclement weather that it would find it impossible to signal distress between the time that the engine fails, and the moment of landing. As stated in the announcement recently made by Secretary Denby, "When one machine is forced to land suddenly, the other finds out by a visual signal whether its mate needs help or whether repairs can be made in a few minutes.

"If the aeroplane down is able to continue its flight in a few minutes, the machine in the air continues circling overhead, makes a radio report of the circumstances, and when its mate has taken off, reports that the flight is resumed. If the aeroplane down must take a long time to make repairs or require a tow to get to port, the machine in the air reports the circumstances by radio and then goes alone to its destination."

In cases of distress when immediate assistance is needed the second machine flashes a report to this effect, and then lands, where possible, to lend assistance to the disabled 'plane.

In addition to making forced landings the leader of each pair of 'planes will be required to make a report of their position each half hour. If both 'planes are forced down simultaneously, then, with opportunity for flashing a signal, the ship or station will be able to approximate their position with a fair degree of accuracy.

Congressman Proposes Radio Station in Capital

The bill introduced by Congressman Vincent M. Brennan of Michigan, serving his first term in the House of Representatives, to install a powerful radio transmitter on the floor of the House, indicates an entirely new field of radio activity.

Hitherto the radio has been employed on a large scale to broadcast news of public events—reports of political events, athletic and sporting contests, public conditions, etc.—but with the passage of Congressman Brennan's bill and the subsequent opening of the Congressional station, the events themselves would be broadcasted. It would be the difference between seeing a prize fight and reading about it in the newspapers.

Entire new vistas open themselves if this measure is approved. Wireless transmitters at diplomatic parleys, thus actually obtaining "open covenants openly arrived at." Perhaps some day it will be possible to get all the thrills of a murder trial without being crushed by the mob struggling to get in the court room.

Aerial Still Perplexes Many Beginners at Radio

The aerial is a point that has not yet been thoroughly cleared up in the minds of many beginners. The aerial should be composed of one wire about 100 feet long. Remember that two wires each fifty feet long will not give the same results and also that the aerial should run all in one direction. The aerial that is full of bends is not very efficient and a straight line aerial is far superior. The lead-in should always be taken from one end, as the T aerial is not particularly good for receiving. The short end of such an aerial is absolutely wasted, and is not helping the set a single bit. The indoor aerial is not much good unless there are several stages of amplification used, and is far below the outdoor aerial in efficiency. Several people have written in, disputing this claim, but probably their outdoor aerials have not been constructed correctly. The indoor aerial will not work with a crystal set unless the owner is located very near the station that he wants to receive.

The wire in the aerial should be of copper of almost any size as long as it is strong enough to support its own weight. Remember that some of the smaller sizes of wire will not withstand the rigors of a sleet storm, and the owner does not want to keep erecting a new aerial every time it comes down.

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GETTING STARTED? All right, we have a stock of Airplanes and Motors ready to fly.
KEEPING GOING? We can help you hecause we are the largest commercial aviation supply housa in tha country.
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New shock absorbers, per foot ...... .05
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New hose clamps, all sizes ...... $ .10
New Hartsell propeller, new design, brass tipped 00.00
New Warner tachometer with shaft 8.00
New thermometer, 15 ft. tube 7.00
New altimeters, 20,000 foot, luminous dial 10.00

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MUST SELL MY JENNIE, new OX5, run only few hours. Little work will complete ship. $450.00. Carl W. Mueller, 5680 Oak Grove Ave., Oakland, California.

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FOR SALE CHEAP—Standard fuselage with new 200 H.P. Curtiss motor, never run. Would trade for automobile. H. V. Farris, 1228 Brook St., Louisville, Ky.

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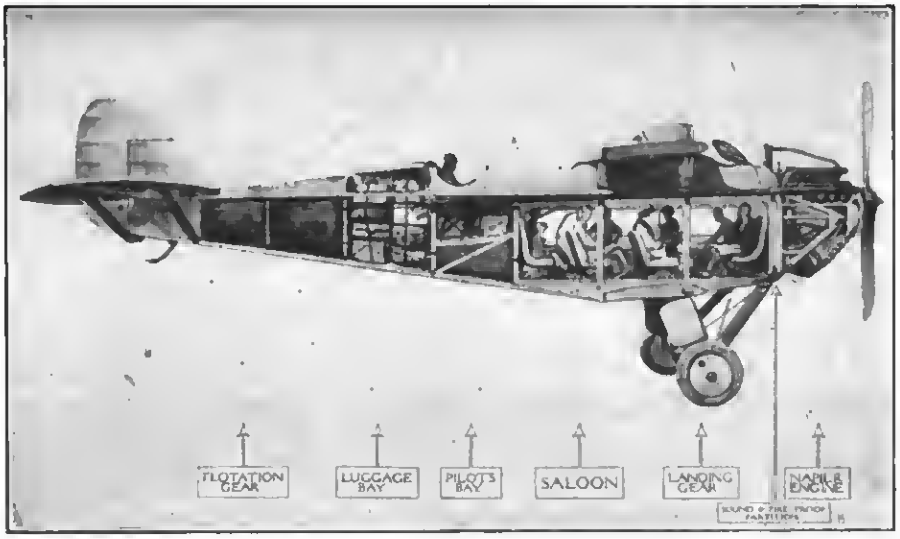

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AERIAL AGE WEEKLY

VOL. 15, No. 10 MAY 15, 1922 10 CENTS A COPY

Including Radio Section

The National Spring Flying Meet at Curtiss Field Photographed by the Fairchild Aerial Camera Corporation

Navy to Use Metal Planes—Landing Fields in the United States—The Versatile Aeroplane

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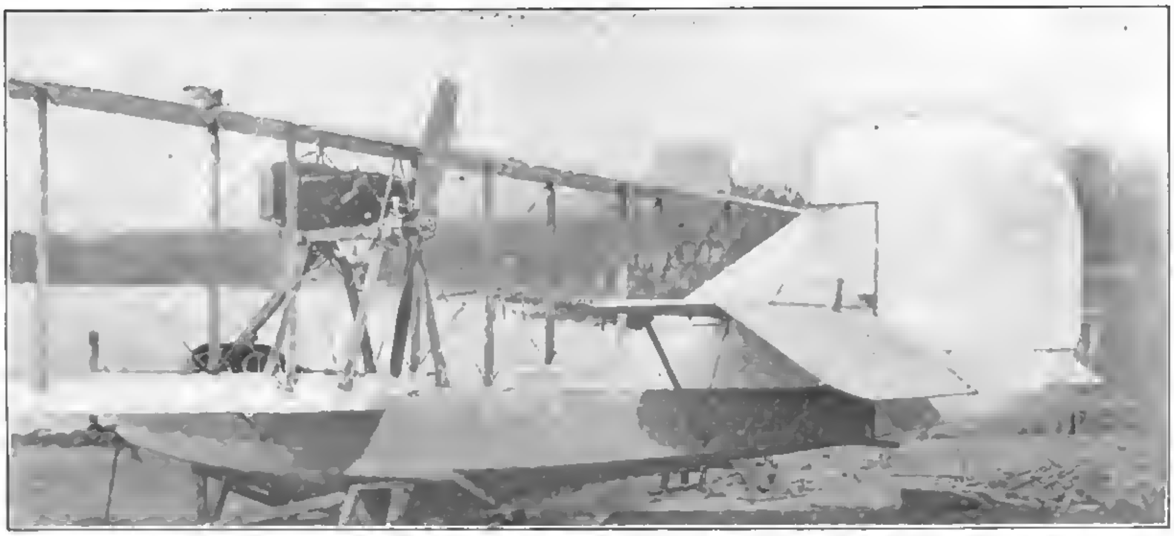

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May 15, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 10

TABLE OF CONTENTS

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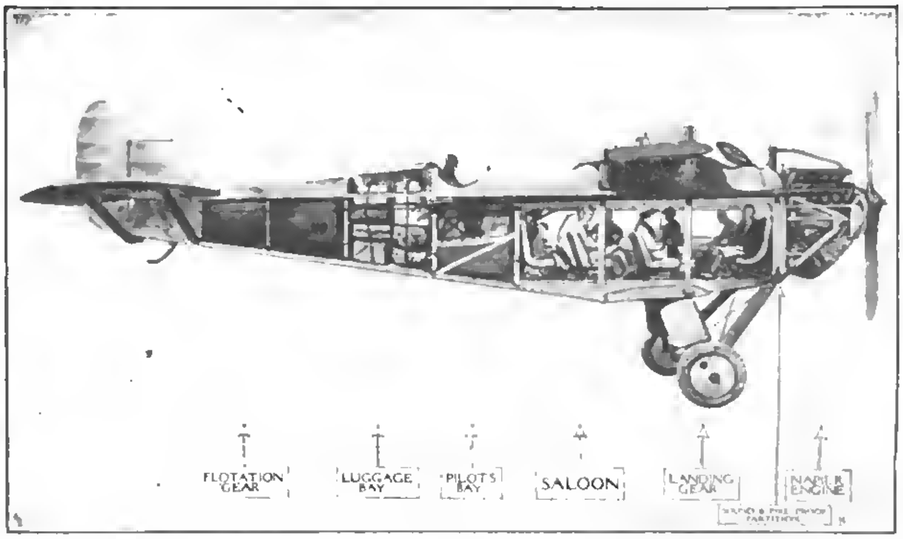

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PUBLISHED WEEKLY BY THE AERIAL AGE CO., 5942 Grand Central Terminal, New York City

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VOL. XV — NEW YORK, MAY 15, 1922 — No. 10

Navy to Use Metal Seaplanes

SECRETARY DENBY of the Navy Department on May 7 authorized an announcement that the Glenn L. Martin Company of Cleveland, Ohio, has undertaken the development for the Naval Bureau of Aeronautics of a number of seaplanes to be constructed of duralumin, a special alloy of metal, and to be used by the fleet for spotting gunfire at long ranges.

The construction of metal aircraft of duralumin is a departure for this firm, which hitherto has built planes of the ordinary wood and wire type, such as the well-known Martin bombers which were used last Summer in the aeroplane bombing attacks that destroyed a number of former German ships off the entrance to the Virginia Capes.

The development of metal aircraft construction in the United States, Secretary Denby said, has been made possible by the Navy Department in that the special alloy metal, duralumin, originally developed in Germany, has been introduced to American manufacturers in connection with the construction of the rigid airship ZR-1 at the naval aircraft factory at Philadelphia. This work has now progressed to the point, according to naval aviation experts, where duralumin of proper quantity, and in all of the useful shapes is now available to any aircraft builder from at least two American commercial sources. The naval aircraft factory at Philadelphia has also developed special machinery and processes for its fabrication.

Aircraft manufacturers transacting business with the Bureau of Aeronautics of the Navy have been invited frequently to visit the factory at Philadelphia to observe the metal fabrication of the work that is going on there. Besides the construction of the giant rigid airship ZR-1, the parts of which are being manufactured at Philadelphia for erection at the naval air station at Lakehurst, the factory is also building metal wings, pontoons and other parts for seaplanes.

Just as the surface fleet of the navy passed by the stages of evolution through the era of wood into that of steel, so it is predicted by experts that the air fleet of the naval service will proceed from the period of wood and linen to that of metal.

Secretary Denby said that the Stout Engineering Laboratories, Inc., of Detroit, were also working with duralumin. This firm has received a contract from the Navy Department for the construction of experimental torpedo-carrying seaplanes to be built entirely of metal, and a simple machine of this character is now under trial flights. Other manufacturers in work for the Navy, it was disclosed, have employed duralumin for parts of aeroplanes with success, notably the Gallaudet Aircraft Corporation of Providence, R. I., and the Aeromarine Plane and Motor Company of Keyport, N. J.

"It is expected," said Secretary Denby, "that future naval aircraft will be built of metal, to an increasing extent. The advantages of metal over wood are especially important for tropical service."

New Recording Devices

AFTER nearly twenty years of flying without knowing just how it was done, new instruments have been devised by the aeronautical experts and pilots of the National Advisory Committee for Aeronautics by which can be recorded what an aeroplane pilot does and how the aeroplane responds. Three special instruments have been perfected to record the speed of the aeroplane in the air, the loadings or changings in weight on the wings and the movement of the controls by the pilot.

Although these instruments are fairly complicated, their operation is simple and mechanical. The recording is done by means of a photographic film. The results reveal for the first time a practical method of securing information in testing new types of aeroplanes and of determining the ability and technique of a pilot. The last function of the instruments will be of great value to the pilots themselves and to instructors of novices, who are seldom able to recall just what they did with the controls at a certain point of a flight.

The first of these new instruments is an air speed meter. Another is used for recording variations in the loading on the wings in flight and the landing carriage when landing, taking off, or running along the ground. In flying through a loop, for example, the pilot is sitting down hard as he goes up and again as he flattens out, but he is literally hanging in his belt at the top of the loop. It is these variations in load on the wings due to the weight of the aeroplane and the aviators in the air, that are recorded by this instrument and also the weight on the carriage while on the ground.

The third device—a control-position recorder—indicates the exact position of all the controls during any manoeuvre or part of a flight. When the pilot gives his ship left-rudder it is recorded in degrees. When he dives by pushing on his "stick," or pulls it back to lift the nose, the movements are shown on the record of the flight. After he lands, there is no argument to what he did, for it is plotted from an automatic record. If one pilot reported that a certain aeroplane was not controllable, he could be checked up by having another pilot put the aeroplane through the same manoeuvres, and then comparing the records of both pilots as delineated by the new instrument.

"These three instruments," the National Advisory Committee for Aeronautics said in a statement issued to-night through the Navy Department announcing their development, "are synchronized to operate simultaneously by means of a timing device which makes possible the co-ordination of the three records into a composite one for study and analysis. The instruments themselves are not bulky, and they do not interfere with the movements of the pilot or the operation of the aeroplane. All the attention they require is the throwing of a switch before a manoeuvre is begun and when it is completed to set them all in operation and to stop them.

"When the flight is completed the photographic records with their delineations of the pilot's movements and the aeroplane's

(Concluded on page 232)

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THE NEWS OF THE WEEK

British Airship R-36 Declined by America

The United States Government has declined an offer by the British Government to turn over the rigid airship R-36 in final settlement of the account over the destruction of the ZR-2.

It is understood the reason for the American refusal to take the airship was based on the fact that to change her back from commercial to military service would mean a large expenditure of money, which Congress might be unwilling to provide.

Further, it has been decided, for the present at least, to keep clear of foreign built airships, this being determined upon in consequence of the loss of the ZR-2 and the Roma.

The American Government, however, has not abandoned airships, and is going ahead with the construction of the ZR-1, at Philadelphia and Lakehurst, N. J. It will be a year, however, before the airship is finished.

British World Flight

LONDON.—Major W. T. Blake of the Royal Air Force has been invited to take the place of Sir Ross Smith in the proposed round-the-world flight, The London Evening Star announced April 27.

Major Blake told the Star he was taking Captain Norman MacMillan, but he had not decided on the type of flying machine to be used. The route will be through France, Italy, Greece, Egypt, Mesopotamia, India, Eastern China, Japan, thence via the Aleutian Islands across to Alaska, through the United States to New York, thence to Newfoundland and then across the Atlantic via Greenland and Iceland to Scotland.

Major Blake expects to start about the end of May and plans to complete the trip in two months.

Protests Against Reduction Appropriation Army Air Service

Protests were made by Major Gen. Mason M. Patrick, Chief of the Air Service, and Brig. Gen. William Mitchell, Assistant Chief of the Air Service, in a hearing that was accorded them by the sub-committee of the Senate Committee on Appropriations on April 12. They were accompanied by Lient. Col. A. L. Fuller and Major J. Y. Chisum, of the Air Service, and Dr. R. B. Moore, Chief Chemist of the Bureau of Standards.

General Patrick discussed at length the reduction that would restrict the activities of the Service with the Organized Reserves and the R. O. T. C. General Mitchell discussed lighter-than-airships, and the importance of maintaining the enlisted personnel of the Air Service.

General Patrick objected very seriously to the cut of $260,000 made by the House in the appropriations for civilian personnel. He showed how this would interfere with the operations of the Service. The general explained that the House had made a reduction of $810,000 in the allowance for normal operations; a reduction of $201,000 in the appropriations for field hangars. He also called attention to the importance of appropriating sufficient funds for experimental research, so as to keep the Service abreast with the progress of aviation.

General Mitchell, who recently returned from Europe, strongly argued for adequate appropriations for lighter-than-airships. He pointed out the value of lighter-than-airships, giving an account of how aeroplanes were launched from dirigibles. He also described how experiments in foreign countries were being made by landing aircraft on suspended wire-arrestors. These wire-arrestors, he explained, would greatly increase the value of lighter-than-airships.

General Mitchell in discussing the personnel problems declared that it was necessary to keep up the enlisted personnel of the Air Service in order to maintain the equipment of the Air Service.

Both urged legislation for a distinguished flying cross to be awarded for extraordinary hazardous and important missions in the Air Service. They cited an instance of the Atlantic Ocean flight as a need for such a decoration.

Dr. Moore explained the necessity for an increase of the appropriations for helium gas, if the gas was to be manufactured in sufficient quantities for the Army and Navy.

Kentucky Encourages Aviation

That the State of Kentucky is fully cognizant of the important rôle slated for aviation in the economic and industrial life of the country is manifested by the recent action of the State Legislature in passing a Resolution requesting all towns and cities in the Blue Grass State to print in large letters the names of such respective towns and cities in such conspicuous place as may be observed by aviators passing over such towns and cities.

Captain Harry B. Flounders, Air Service, stationed at Camp Knox, Ky., is directly responsible for the introduction and passage of this Resolution. This officer is also endeavoring to work up interest in aviation in the other states of the Fifth Corps Area, in order to have a similar Resolution passed. Officers stationed at Godman Field, Camp Knox, Ky., are giving lectures at various localities throughout Kentucky, and the State is taking a very active interest in the development of aviation.

It is hoped that the worthy example set by the State of Kentucky will soon be followed by the other states of the Union, as the importance of such identification signs cannot be overestimated. Several aviation accidents have occurred by virtue of the fact that aviators have lost their bearings and, being forced to fly low in order to catch some identification sign of the town, they were flying over, collided with some telegraph wires or a building or found it necessary to land in a restricted place.

The Resolution, as passed by the Commonwealth of Kentucky, is as follows:

"Whereas much interest is being taken in the subject of aviation, especially in the subject of carrying the mails by such method, and,

Whereas aviators experience much difficulty in ascertaining the name of many towns and cities over which they are flying; and,

Whereas there are but few natural objects near the many towns and cities in this Commonwealth whereby such aviators passing over the same can ascertain the names of such towns and cities; therefore,

Be it Resolved by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the Mayors of all towns and cities in this Commonwealth are hereby requested to have painted in letters sufficiently large to be seen at a considerable distance, the name of their respective towns and cities upon the top of some building or eminence in order that aviators in passing over such towns and cities may be able to ascertain readily the name of such town or city.

Section 2. That the Clerks of the Senate and the House of Representatives of the General Assembly of Kentucky shall transmit certified copies of this resolution addressed to the Mayor of each town and city in this Commonwealth."

Spokane News

Spokane, Wash.—With the status of the Parkwater municipal aviation field settled, as under the direct control of the city parks board with regulations to be governed by federal rules, C. H. Messer, head of the United States Aircraft Corporation, has announced plans for extensions, including immediate reduction in rates.

A new three-passenger and pilot plane has been put into service, in which a party of three can make a trip anywhere. It will be operated by Nick Mamer, chief pilot for the concern.

Work has begun installing radio equipment at the hangar and on the ships. Workmen also began the construction of markers on both the lower field, now in use, and the upper or east-end field, at the northeast corner of the city's tract.

At its last meeting the park board decided to make no lease for the field and to operate it as a municipal field, open to the public, with any flyer being privileged to use the field by the securing of a permit and the payment of $5 per ship per season. Desire to foster aviation, rather than to get money out of the field, prompted the board in its action.

Mr. Messer, who now uses the field and has a hangar for four ships constructed there, was given the first permit.

Tom Symons and Bill Barnard, local flyers, announced that they would make Mr. Messer's hangar their headquarters here.

An agency for Curtiss ships and products has been secured by Mr. Messer.

Aero Club of Jordan, Mont.

An aero club has recently been organized at Jordan, Mont., as an auxiliary of the Aero Club of Miles City. The members and officers are: Mr. Floyd Tollefson, President; Mr. S. C. West, Vice-President; Mr. G. B. Hart, Secretary-Treasurer; Mr. H. A. Hetherington and Mr. George Ayer. These are all prominent business men in their town which is located 40 miles from the nearest railway.

Medina Aviation Club

The Medina Aviation Club has been organized at Medina, Ohio. H. R. Calvert is president and general manager, A. B. Pritchard, secretary and treasurer, W. P. Goembel, instructor, and J. A. Ray, chief mechanic. The club has taken over the Budd Sanford outfit of Brunswick, Ohio, and is operating a "Canuck" and a "Waco" Model 4, built by the Weaver Aircraft Co.

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The AIRCRAFT TRADE REVIEW

Cox-Klemin Purchase M.F. Boats

The Cox-Klemin Aircraft Corporation, of College Point, Long Island, have purchased 57 MF. flying boats from the Navy Department. The boats are in excellent condition, the majority of them never have been uncrated. Some of the boats will have 0xx6 motors installed, and those who desire a more speedy boat will have 180 h.p. Hispano motors.

Business Men Willing To Pay Air Mail Rates

Washington.—Business men generally would be willing to pay extra postage on air mail provided the safety of the mail and quick and certain delivery could be guaranteed, representatives of the Aeronautical Chamber of Commerce, the Merchants Association of New York and other organizations contended April 28th before the House Postoffice Committee. The Steenerson bill, under which the Postmaster general would be authorized to provide star air routes, was up for hearing.

F. B. De Berard, of the merchant's association, said if a highly improved method for expediting the mail were adopted, the public would rapidly avail itself of its use. But to be effective the aeroplane service must be operated by night, with plenty of equipment and landing, repair and supply stations, he added.

The Steenerson bill would fix the first class rate of postage on air mail at not less than 6 cents for each ounce or fraction, and would authorize the Postmaster General to contract with companies for transportation of first class mail by aircraft at a rate not exceeding two mills a pound a mile, and mail other than first class at a rate not exceeding one-half a mill a pound a mile.

Weaver Aircraft Company Moves

The Weaver Aircraft Company, manufacturers of the "Waco" Model 4 and the "Cootie" one-passenger baby plane have moved to Medina, Ohio, thirty-five miles southeast of Lorain, and are now manufacturing several planes on contract. They are receiving a large number of inquiries from all parts of the country regarding the "Waco" Model 4.

Air Mail Division Sale

Sealed proposals will be received at the office of the Second Assistant Postmaster General, Washington, D. C., covering certain aeronautic equipments, full details of which can be secured from C. F. Egge, General Superintendent, Air Mail Service.

The Santa Maria

The Aeronautical Chamber of Commerce of America, 501 Fifth Avenue, New York City, on April 26 pointed to the safe arrival at Nassau of the flying cruiser "Santa Maria" (mentioned in newspaper dispatches from Miami, Florida as having been out overnight in the Gulf Stream) as another indication of the safety of over-water, aerial transportation when conducted by a Company sufficiently well organized and financed to maintain their equipment in the best possible condition.

The "Santa Maria" which is operated by the Aeromarine Airways left Key West for Nassau Monday on a three hundred and fifty mile emergency flight.

Due to the fact that they were compelled to buck a strong head wind which greatly retarded their speed, the pilot on seeing that his gas supply was getting low decided to come down at Billy Island in the Bahamas and after sighting a small harbor made a safe landing, taxied up to the beach and awaited gasoline which he knew would be sent out by the relief boat.

In the meantime, the passengers amused themselves strolling up and down the beach and preparing a good dinner from the supply of rations aboard the ship.

As soon as possible the passengers were transferred to a fishing schooner and taken on to Nassau. When the Navy flying boat under the command of Captain Bartlett and Lieutenant Miller located the "Santa Maria" they sent out a wireless stating where she was located, then made a landing and supplied the "Santa Maria" with sufficient gasoline and she continued on her course to Nassau.

The Aeromarine Airways, which operates a fleet of flying boats between Florida and points in the Bahamas and the West Indies, have flown over 150,000 miles, carried over 10,000 passengers without a single serious mishap.

In commenting on the experience of the "Santa Maria," C. F. Redden, President of the Company said: "We did not have the least apprehension for the safety or even the comfort of the passengers on the "Santa Maria" because the boat is as much in its element on the sea as it is in the air. It was equipped with two 400 horsepower Liberty motors and even tho they were compelled to land at sea on account of motor trouble, the auxiliary motor would enahle her to taxi to some safe harbor.

"The boat is a huge eleven-passenger enclosed-cabin cruiser provided with sufficient food and water to maintain its passengers for a week and the big reclining chairs and settees which are more comfortable than the average Pullman reclining chairs were such that the passengers need suffer no hardship either night or day.

"Our system of rigid inspection and maintenance has enabled us to operate successfully for two years without serious trouble and the wonderful record of these flying boats in the service of the United States Navy is an eloquent testimonial to their sea and air worthiness and general reliability."

The "Santa Maria" will leave Nassau in a few days for Washington and New York where it will be in regular service between New York and Atlantic City.

Assistant Aeronautical Engineer

The United States Civil Service Commission announces an open competitive examination for assistant aeronautical engineer. A vacancy in the position of aeronautical engineer, Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., at $7.20 per diem, and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applicants should apply for form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.

The Airplane Engine

The author, Lionel S. Marks, Professor of Mechanical Engineering, Harvard University, presents in this book a treatment of the aeroplane engine that is so thorough and detailed that it will be accepted at once as the standard work in this field.

It is the first adequate discussion of the aeroplane engine, design and construction to be published in this country.

It is based mainly on the researches and engine developments originating during the war and resulting from the war's urgencies. It includes the results of investigations carried on by the United States, the British, the French and the German governments.

The chapter headings are: Power Required and Power Available, Engine Efficiencies and Capacities, Engine Dynamics, Engine Dimensions, Materials, Engine Details, Valves and Valve Gears, Radial and Rotary Engines, Fuels and Explosive Mixtures, The Carburetor, Fuel Systems, Ignition, Lubrication, The Cooling System, Geared Propeller Drives, Supercharging, Manifolds and Mufflers, Starting, Potential Development.

Pistons

The Aluminum Manufacturers, Inc., Cleveland, have just published "Pistons—A Reference Book," which should be in the hands of every engine mechanic. It discusses the functions of pistons, piston troubles, piston design, and things to be observed to insure successful piston operation.

COMING AERONAUTICAL EVENTS

AMERICAN

May		—National Balloon Race.
Sept. 4. (*about*)		—Detroit Aerial Water Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)
Sept. 15. (*about*)		—Detroit Aerial Derby, Detroit. (Pulitzer Trophy Race.)
Sept. 30.		—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1. (*about*)		—Coupe Jacques Schneider. (Seaplane speed race.) Italy, probably Veniee.
Aug. 6.		—Gordon Bennett Balloon Race, Geneva, Switzerland.
Oct. 1.		—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) Franee. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

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LANDING FIELDS IN THE UNITED STATES

The following landing fields have been reported to the Office of the Chief of Air Service, War Department, since January 1, 1922:

Arkansas

Ogden.—Latitude 33° 35′ N., longitude 94° 00′ W.
Reported by the National Aircraft Underwriters Association; no data.
Van Buren.—Latitude 35° 24′ N., longitude 94° 21′ W. No data.

California

Colfax.—Latitude 39° 07′ N., longitude 120° 57′ W.
Small emergency field, 600 by 300 feet; soft, wet, level; ½ mile south of city; altitude 2,422 feet.
Courtland.—Latitude 38° 20′ N., langitude 121° 30′ W.
Emergency; 129 miles from Reno, 58 miles from San Francisco; nearest railroad station, Hood; long distance telephone only; gas and oil; ½ mile east and 3 miles southeast of town are large level cultivated fields where safe landing could probably be made, but take-off difficult owing to soft ground or growing crops. Landmark, Grand Island Drawbridge, 2¼ miles south of town.
Elsinore.—Latitude 33° 40′ N., longitude 117° 20′ W.
Emergency, good; located south of town and railroad, one mile west of river and north of lake; square; 40 acres; garage service; altitude 1,300 feet.
Franklin.—Latitude 38° 25′ N., longitude 121° 25′ W.
Emergency; 122 miles from Reno, 65 miles from San Francisco; Western Pacific Railroad; long distance telephone and telegraph; gas and oil; tract for landing field adjoining town and ¼ mile southwest of railroad. Landmarks, church in one corner of field, Western Pacific Depot, and Great Western Power Company's towers.
Freeport.—Latitude 38° 27′ N., longitude 121° 30′ W.
Field 1,800 by 2,000 feet, located 115 miles from Reno and 72 miles from San Francisco, on Southern Pacific Railroad. Long distance telephone only; gas and oil. Landmarks, two steel towers, 185 feet high, one on each side of the Sacramento River, west of town.
Garden Valley.—Latitude 38° 52′ N., longitude 120° 50′ W.
Field 72 miles from Reno, 115 miles from San Francisco; nearest railroad at Placerville. Southern Pacific, about 12 miles by road. Long distance telephone only; no supplies; not a good landing place; very rocky and hilly.
Georgetown.—Latitude 38° 55′ N., longitude 120° 50′ W.
Field 70 miles from Reno, 117 miles from San Francisco; 18½ miles to Placerville, nearest railroad staion; long distance telephone only. Field unplowed land 1,800 by 3,000 feet, located 1 mile east of town; slight grade, no obstructions; a large isolated hill on eastern boundary.
Holtville.—Latitude 32° 45′ N., longitude 115° 24′ W.
Emergency; southeast and near town; 2,500 by 2,500 feet; another field further southeast.
Mills.—Latitude 38° 36′ N., longitude 121° 20′ W.
Mather Field, 103 miles from Reno, 84 miles from San Francisco, on Southern Pacific Railroad; long-distance telephone and telegraph. Field 1 mile south, American River 1 mile north of town.
Natoma.—Latitude 38° 40′ N., longitude 121° 12′ W.
95 miles from Reno, 92 miles from San Francisco; long-distance telephone only; supplies; field covered with dredge tailings. Land at Folsom, 1½ miles north. Natoma painted on both sides of barn.
Perris.—Latitude 33° 48′ N., longitude 117° 15′ W.
High School Field, ¼ mile north, near school and between railroad and boulevard; 30 acres; good in wet weather; supplies; another field 1 mile southeast.
Polaris.—Latitude 39° 23′ N., longitude 120° 10′ W.
Emergency; 22 miles from Reno, 165 miles from San Francisco, on Southern Pacific Railroad. Long-distance telephone only; no supplies; possible landing 1 mile north.
Seeley.—Latitude 32° 50′ N., longitude 115° 42′ W.
Municipal Field (for air mail) west of town; railroad and highway run east and west; supplies.
Shingle Springs.—Latitude 38° 40′ N., longitude 120° 54′ W.
7 miles south and east of the air-mail course, on the Placerville branch of the Southern Pacific Railroad. Field 1,500 by 300 yards, ½ mile west of town, bounded by the highway on the south and the railroad on the north; level, hard, and smooth; altitude 1,000 feet.
Slatington.—Latitude 38° 50′ N., longitude 120° 48′ W.
73 miles from Reno, 114 miles from San Francisco, 6 miles to railroad station at Placerville; telephone and telegraph; supplies; many suitable landing places.
Suisun.—Latitude 38° 15′ N., longitude 122° 03′ W.
Field 2,000 by 5,000 feet; in a strategic position for flying in the Sacramento valley; level, bounded by fences and road on the south; supplies; altitude 100 feet.
Truckee.—Latitude 39° 20′ N., longitude 120° 13′ W.
Good summertime landing, 600 by 2,000 feet, near the junction of Lake Tahoe and Southern Pacific Railroads; deep snows in winter. Maintain altitude of 15,000 feet in crossing the Sierras at this point. Landing field prepared by the citizens 3 miles out on the highway; supplies.
Tracy.—Latitude 37° 43′ N., longitude 121° 27′ W.
Emergency; ball ground, 1,600 by 1,100 feet, between railroad branch and six big tanks and water tower.
Wilmington.—Latitude 33° 44′ N., longitude 118° 17′ W.
Smith Aircraft Company's field, 1¼ miles west of town, 2,000 by 1,000 feet along the boulevard; good in any weather.
Winchester.—Latitude 33° 42′ N., longitude 117° 06′ W.
In Domenegoni Valley; no data.
Yosemite.—Latitude 37° 45′ N., longitude 119° 37′ W.
National Park Field.

Colorado

De Beque.—Latitude 39° 20′ N., longitude 108° 13′ W.
Emergency field in vicinity.
Gypsum.—Latitude 39° 42′ N., longitude 106° 55′ W.
Emergency field in vicinity.
Malta.—Latitude 39° 16′ N., longitude 106° 20′ W.
Level fields for emergency landings; altitude 9,580 feet.
New Castle.—Latitude 39° 34′ N., longitude 107° 32′ W.
Level fields for emergency landings.
Riverside.—Latitude 38° 57′ N., longitude 106° 12′ W.
Level fields for emergency landings.
Wolcott.—Latitude 39° 41′ N., longitude 106° 41′ W.
Level fields for emergency landings.

Connecticut

Stamford.—Latitude 41° 03′ N., longitude 73° 32′ W.
Halloween Park, emergency, 2½ miles south of town.

Florida

Apalachicola.—Latitude 29° 44′ N., longitude 84° 58′ W.
Landing for seaplanes only.
Green Cove Springs.—Latitude 29° 29′ N., longitude 81° 41′ W.
Landing for seaplanes only.
Palatka.—Latitude 29° 19′ N., longitude 81° 38′ W.
Landing for seaplanes only.

Georgia

Thomasville.—Latitude 30° 53′ N., longitude 83° 58′ W.
Spence Field, municipal, 1,100 by 350 feet; good in wet weather; marked by a T within a circle; between highway and railroad; altitude 275 feet.
West Rome.—Latitude 34° 07′ N., longitude 85° 06′ W.
Reported by the National Aircraft Underwriters' Association; no data.

Idaho

Hope.—Latitude 48° 15′ N., longitude 116° 20′ W.
Field situated halfway to Sand Point, north of lake.
Lewiston.—Latitude 46° 25′ N., longitude 117° 03′ W.
Emergency; good; 2,100 by 3,000 feet; northwest of race track; marked by T; altitude 750 feet.

Illinois

Ashburn (Chicago).—Latitude 41° 45′ N., longitude 87° 40′ W.
Aero Club of Illinois Field; 10 miles from Congress Hotel; one mile square; three hangars; soggy when wet; supplies and service by Ralph C. Diggins Company Flying School. (See Notice to Aviators 3 (24) of 1922).
Beardstown.—Latitude 40° 01′ N., longitude 90° 25′ W.
For seaplanes only; difficult landing in cross winds; flying boat anchor must be used; fuel ordered in advance.
Cairo.—Latitude 37° 00′ N., longitude 89° 11′ W.
For seaplanes only; flying boat anchor must be used; fuel ordered in advance; Chamber of Commerce will cooperate.

Indiana

Anderson.—Latitude 40° 05′ N., longitude 85° 40′ W.
32 acres rented and operated by Mr. E. B. Bridges.

Iowa

Missouri Valley.—Latitude 41° 32′ N., longitude 95° 55′ W.
Field of Missouri Valley Aero Co.; hangars, etc., Messer Pasture.
Webster City.—Latitude 42° 28′ N., longitude 93° 48′ W.
Field of the Webster City Aero Com-

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pany; on northwest edge of town; 50 acres; ideal; canvas hangars; marker; high test gas and oil.

Kansas

Junction City.—Latitude 39° 02' N., longitude 96° 48' W.

Camp Funston; reported by the National Aircraft Underwriters Association; no data.

Lawrence.—Latitude 38° 58' N., longitude 95° 12' W.

Reported by the National Aircraft Underwriters Association; no data.

Kentucky

Barbourville.—Latitude 36° 51' N., longitude 83° 53' W.

Commercial field and flying school.

Lexington.—Latitude 38° 03' N., longitude 48° 30' W.

Race track field.

Louisiana

Houma.—Latitude 29° 35' N., longitude 90° 42' W.

Municipal field; on fair grounds and 16 acres adjoining.

Pineville.—Latitude 31° 20' N., longitude 92° 25' W.

Reported by the National Aircraft Underwriters Association; no data.

Welsh.—Latitude 30° 14' N., longitude 92° 47' W.

Emergency; rice farm, 500 by 1,500 feet; 1½ miles west of town between railroad and highway, near stream; 18 miles east of Lake Charles.

Maine

Auburn.—Latitude 44° 06' N., longitude 70° 15' W.

Northeast Aeroplane Co. Field; small.

Maryland

Cambridge.—Latitude 38° 35' N., longitude 76° 04' W.

Seaplanes only.

Chestertown.—Latitude 39° 12' N., longitude 76° 04' W.

Seaplanes only.

Crisfield.—Latitude 37° 59' N., longitude 75° 52' W.

Seaplanes only.

Easton.—Latitude 38° 46' N., longitude 76° 05' W.

Seaplanes only.

Ocean City.—Latitude 38° 20' N., longitude 75° 05' W.

Seaplanes only.

Oxford.—Latitude 38° 41' N., longitude 76° 11' W.

Seaplanes only.

Salisbury.—Latitude 38° 22' N., longitude 75° 36' W.

Seaplanes only.

Massachusetts

Auburn.—Latitude 42° 12' N., longitude 71° 49' W.

Emergency; 900 by 1,000 feet; stone wall south and east.

Cliftondale.—Latitude 42° 27' N., longitude 71° 01' W.

6 miles north of Boston, on race track. Land east and west on north track only.

Danvers.—Latitude 42° 34' N., longitude 70° 56' W.

Emergency; 30 acres, square; north of reservoir, along road.

Dorchester.—Latitude 42° 18' N., longitude 71° 03' W.

Franklin Field Playground; dangerous; 50 acres; near Boston; emergency only.

Greenfield.—Latitude 42° 37' N., longitude 72° 35' W.

The Meadows Field; ½ mile square; 3½ miles out along road; 2 miles from Deerfield.

Hingham.—Latitude 42° 14' N., longitude 70° 53' W.

Emergency field, 15 miles south of Boston; 1,800 by 700 feet.

Nantasket Beach.—Latitude 42° 17' N., longitude 70° 52' W.

Kenberma Park Field; L shaped, near beach; marked with circle; service and supplies by American Aerial Corporation of Boston.

North Beverly.—Latitude 42° 33' N., longitude 70° 53' W.

Emergency; 25 acres, southeast of reservoir; 3 miles out.

Revere.—Latitude 42° 24' N., longitude 71° 00' W.

Field of the Lynnway Aircraft Corporation; 30 acres; hangars and supplies; along the boulevard between Revere Beach and Lynn.

South Sudbury.—Latitude 42° 22' N., longitude 71° 27' W.

Field of American Aerial Corporation; 15 miles west of Boston; 25 acres, along highway at railroad crossing; marked by the letter A inside a circle; service and supplies.

Michigan

Alpena.—Latitude 45° 05' N., longitude 83° 27' W.

For seaplanes only; moorings not so good on account of town being on open lake; flying-boat anchor must be used; fuel ordered in advance.

Harbor Springs.—Latitude 45° 25' N., longitude 85° 00' W.

No data.

Holland.—Latitude 42° 48' N., longitude 86° 05' W.

Seaplanes only; good landing on lake; flying-boat anchor must be used.

Mackinaw.—Latitude 45° 45' N., longitude 84° 45' W.

Seaplanes only; mooring hazardous except in smooth weather.

Manistique.—Latitude 45° 58' N., longitude 86° 15' W.

Reported by the National Aircraft Underwriters Association; no data.

Manistee.—Latitude 44° 14' N., longitude 86° 22' W.

Seaplanes only; good in open lake if water is smooth; must be taxied between two breakwaters into small harbor; flying-boat anchor must be used.

Muskegon.—Latitude 43° 13' N., longitude 86° 15' W.

Seaplanes only; shallow water and rocks; mooring facilities good.

Petoskey.—Latitude 45° 22' N., longitude 84° 58' W.

Seaplanes only; flying boat can be tied to dock; anchor must be used.

Port Huron.—Latitude 42° 58' N., longitude 82° 24' W.

Seaplanes only; mooring facilities not good on account of current.

Saginaw.—Latitnde 43° 28' N., longitude 83° 58' W.

Fair grounds; ½-mile track; 2 miles east of town; clear approach.

Traverse City.—Latitude 44° 45' N., longitude 85° 38' W.

Seaplanes only; city on open lake; weather must be watched.

Minnesota

Amboy.—Latitude 43° 53' N., longitude 94° 09' W.

Emergency; no data.

Hibbing.—Latitude 47° 28' N., longitude 92° 54' W.

Pritchard Field to south; ideal; to be used by forest patrol pilots.

White Bear Lake.—Latitude 45° 06' N., longitude 93° 00' W.

Harold Peterson Aircraft Co. Field.

Mississippi

Aberdeen.—Latitude 33° 47' N., longitude 88° 27' W.

Fair Grounds; in race track; emergency.

Laurel.—Latitude 31° 42' N., longitude 89° 02' W.

Municipal fair grounds; 830 by 310 feet, in ½-mile track; Madison Station.

Natches.—Latitude 31° 34' N., longitude 91° 20' W.

Seaplanes only; landing facilities good; fuel ordered in advance.

Missouri

Bogard.—Latitude 39° 28' N., longitude 93° 30' W.

Emergency; no data.

Bridgeton.—Latitude 38° 45' N., longitude 90° 24' W.

Emergency; no data.

Clinton.—Latitude 38° 22' N., longitude 93° 46' W.

Owen Farm Field, 1 mile east long road, near cemetery; 40 acres; good when wet.

Ester.—Latitude 37° 51' N., longitude 90° 31' W.

Reported by the National Aircraft Underwriters Association; no data.

Mexico.—Latitude 39° 10' N., longitude 91° 53' W.

Old Fair Grounds Field; 100 acres, two miles southeast of town.

Moberly.—Latitude 39° 26' N., longitude 92° 27' W.

Emergency; no data.

St. Francis.—Latitude 37° 52' N., longitude 90° 32' W.

Emergency; no data.

Willow Springs.—Latitude 36° 59' N., longitude 91° 59' W.

Emergency; no data.

Montana

Bridger.—Latitude 45° 14' N., longitude 108° 57' W.

Curtiss-Montana Aeroplane Company Field, near race track, on runway, 1,800 feet square; soft if wet; hangar barn.

Butte.—Latitude 46° 00' N., longitude 112° 33' W.

Municipal; along stream between Railroad track and road; 80 acres; marked with T; ideal; service and supplies.

Forsyth.—Latitude 46° 14' N., longitude 106° 44' W.

Woolston Field, 2½ miles southeast along road; 600 by 5,000 feet; ideal; hangar and supplies.

Nebraska

Alliance.—Latitude 42° 06' N., longitude 102° 53' W.

Municipal; reddish field ¾ mile west of town; 50 acres; good when wet.

Bushnell.—Latitude 41° 14' N., longitude 103° 53' W.

Emergency field south of town.

Galloway.—Latitude 41° 17' N., longitude 99° 55' W.

Emergency field south of town.

Dunning.—Latitude 41° 50' N., longitude 100° 05' W.

Emergency field; ideal; east of town in fork of river.

Grand Island.—Latitude 40° 55' N., longitude 98° 20' W.

Grand Island Aero Field; 1½ miles east of town; 75 acres marked with T; good when wet; two hangars; altitude 1,700 feet.

Hastings.—Latitude 40° 35' N., longitude 98° 24' W.

College Camp Grounds; 25 acres, 1½ miles south; college buildings east.

Kearney.—Latitude 40° 42' N., longitude 99° 05' W.

Ranch field on Lincoln Highway; across white stone bridge over Platte River; near academy; hangar and supplies.

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Lexington.—Latitude 40° 46′ N., longitude 99° 44′ W.

Ideal field along road, west of cemetery, 2,640 by 800 feet; good when wet.

Potter.—Latitude 41° 13′ N., longitude 103° 19′ W.

Emergency field about 1 mile west on north side of tracks.

Nevada

Parran.—Latitude 39° 48′ N., longitude 118° 40′ W.

No data.

New Jersey

Brookside.—Latitude 40° 47′ N., longitude 74° 35′ W.

Large unplowed field 58 miles from Mineola, on the railroad. Field of the Eagle Flying Corps; 1,800 feet square, 3 miles from town, east of railroad crossing; red hangar on west; good when wet; mine shaft northeast side; altitude 600 feet.

Elizabeth.—Latitude 40° 40′ N., longitude 74° 14′ W.

Emergency. No data.

Newport.—Latitude 39° 18′ N., longitude 75° 10′ W.

Reported by the National Aircraft Underwriters' Association; no data.

Port Murry.—Latitude 40° 47′ N., longitude 74° 55′ W.

67½ miles from Mineola; suitable for emergency landings; supplies.

Ridgewood.—Latitude 40° 58′ N., longitude 74° 07′ W.

Rouclere Field; commercial; passenger carrying.

Seagirt.—Latitude 40° 07′ N., longitude 74° 02′ W.

Camp Edwards Field; 5,000 by 2,000 feet, along ocean, between barracks and road; very good.

Spring Lake Beach.—Latitude 40° 10′ N., longitude 74° 02′ W.

Emergency; along coast and west of bridge crossing inlet; commercial.

Wrightstown.—Latitude 40° 02′ N., longitude 74° 37′ W.

Camp Dix, 15 miles southeast of Trenton; West Point Cadets in training; emergency.

New Mexico

Garcia Ranch.—Latitude N., longitude W.

Near border monument No. 67; good field with 4-way approach.

New York

Alexandria Bay.—Latitude 44° 20′ N., longitude 75° 55′ W.

Seaplanes only; good landing facilities; use flying boat anchor.

Batavia.—Latitude 43° 00′ N., longitude 78° 11′ W.

Emergency only; fair grounds; poor.

Canton.—Latitude 44° 36′ N., longitude 75° 10′ W.

Fairgrounds; ½ mile track; good field; ½ mile northwest of town.

Cornwall-on-Hudson.—Latitude 41° 26′ N., longitude 74° 00′ W.

Military Academy Field; 500 by 100 yards; good when wet.

Geneseo.—Latitude 42° 48′ N., longitude 77° 50′ W.

Emergency field 1,500 by 1,800 feet, two miles north of town; good when wet.

Lake George.—Latitude 43° 26′ N., longitude 73° 42′ W.

Seaplanes only; excellent landing facilities; aeromarine *Santa Maria.*

Newburgh.—Latitude 41° 30′ N., longitude 74° 00′ W.

Seaplanes only; buoy placed in river by Chamber of Commerce.

Rye.—Latitude 40° 39′ N., longitude 73° 41′ W.

No data.

Tupper Lake.—Latitude 44° 13′ N., longitude 74° 28′ W.

Osley Farm Field; 500 by 1,500 feet; good, fenced, along road.

(To be concluded)

EXPERIMENTAL STUDY OF HABITUATION TO ROTATION

CAN you think of rats—such vermin as rats—serving any good end to aviation?

Science says, "Yes!"

Some of those men who delve into the nooks and crannies and by-paths of the unknown things of life—men whom we call Scientists—have been experimenting on rats in order to add to our knowledge. They have learned much about the most desirable foods for human beings, for instance, from such experiments. And from other kinds of tests already made on rats they have discovered a number of facts that relate to the science of flying. For two years Professor Madison Bentley has conducted elaborate experiments on rats in rotation for the purpose of studying the effect of an animal becoming accustomed to turning around completely on an axis. Rats have been born in this process of rotation. Among the things Professor Bentley has found out is that certain tendencies toward loss of origin through the ear can be inherited. By orientation scientists mean the process by which direction is ascertained.

It is easy to recognize the value of such investigations as those concerned with the materials that go into the making of aircraft, the development of a reliable engine that will use a low grade fuel, or the determination of forces on an aeroplane, or of the interference effects of the structural members.

But few people realize that a small part of the inner ear has much to do with seasickness, and that this same portion of the ear effects the ability of a man to handle an aeroplane or airship.

Since the close of the war the National Research Council has had several projects centering on the studying of human factors in flying, involving behavioristic experiments on man and animals; anatomical, physiological and psychological studies of the functions of the ear and associated eye movements; the writing of a history; and the collection of a complete bibliography on the subject. Last year the workers in this field came together and organized themselves into a committee on Vestibular Research for the purpose of encouraging and co-ordinating work in this field. This committee has formulated a project on "The Experimental Study of Habituation to Rotation," which has been approved by the National Research Council. This project forms a natural nucleus around which may be gathered data from field experience, clinical records of fliers, and facts from laboratory experiments bearing on the subject in such a way as to favor a critical analysis of the situation and lay the foundations for both theory and practice.

The project will be administered by an executive committee, at the present time composed of Dr. J. Gordon Wilson, Chairman, Dr. Raymond Dodge, and Dr. F. H. Pike, in co-operation with the Chairman of the Division of Biology and Agriculture, Medical Sciences and Anthropology and Psychology in the National Research Council.

Dr. Dodge has made himself the outstanding authority on the measurement of eye movements as influenced by orientation through the ear, and it is believed that under his direction there will open up a large field of practical work which can be done to great advantage with a newly designed instrument for use in the study of the balancing power of aviators by photographical methods. Dr. Pike has made valuable contribution to brain anatomy bearing on the relation of the sensory mechanisms in the labyrinth to the sensory mechanism of sight and touch, giving us a new point of view in regard to the function of the ear in conjunction with the visual and tactical sense of orientation in flying. This opens up an entirely new approach to the practical investigation of fitness for flying, and should be followed up both by anatomical studies and by practical tests on flyers. Other scientific men on the committee include Dr. Irving Hardesty, who has undertaken to examine microscopically the Bentley rats, and to construct norms as a basis of comparison for future study of modifications in the air; Dr. S. S. Maxwell, who has made notable contributions to the study of anatomical conditions of orientation through the ear by studies on the shovel-nosed ray and other animals, which present unusually favorable conditions for the investigations of these phenomena; Dr. George L. Streeter, who is engaged in embryological studies of the development of the ear with particular reference to the structural conditions for orientation in flying; Dr. Knight Dunlap, who has equipped a laboratory in Johns Hopkins University at great expense specifically for the investigation of the behavior of human beings under conditions involved in flying; Dr. J. Gordon Wilson, who is now conducting investigations on hearing and the anatomy of this function; Dr. Percy W. Cobb, who has been active on the practical side of the question; Dr. W. H. Wilmer, who did such active work during the war and has been instrumental in securing the cooperation of investigators with reference to the organization of investigations on actual flyers, and Drs. L. R. Jones, V. C. Vaughan, C. E. Seashore, Chairmen of the Divisions of Biology and Agriculture, Medical Sciences, and Anthropology and Psychology of the National Research Council. The last three are ex-officio members of the committee, Dr. Seashore being its chairman.

The air service of the army is giving its active cooperation to the investigators through this special committee. Major Bane, Chief of the Engineering Division of the Air Service, has recently stated that a proper figure for research for experimentation in aeronautics would be ten million dollars annually. "There is no better economy than scientific research," he says. He has chiefly in mind of course research in machinery and materials, but what about the human in the aeroplane? The National Research Council is seeking to find some people who will be interested enough in this fundamental research as to favorable conditions in the aviator to provide not less than $25,000 covering the research investigations of this committee during the period of two years.

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NOTES ON PROPELLER DESIGN—II

The Distribution of Thrust Over a Propeller Blade

By MAX M. MUNK

Technical Note National Advisory Committee for Aeronautics

Summary

THE best distribution of the thrust over the length of the propeller blade is investigated, taking into account chiefly the slip stream loss and the friction between the blades and the air.

The energy losses of the propeller depend noticeably on the distribution of the thrust over the length of the blades, and the losses can be diminished by a favorable distribution. The two induced losses of smaller importance, the loss due to the finite number of blades and the loss due to the rotation of the slip stream, call for a gradual decrease of the thrust per unit of propeller disc area towards the inner and outer end of the blades. Near the center the thrust is naturally less dense, and hence the loss from rotation is generally kept reasonably small without special effort of the designer and no further improvement is here possible. The breadth of the blades, however, is not always tapered towards the tips as much as would be desirable in order to keep small the loss due to the finite number of blades. It is true, the actual thrust distribution is almost as favorable in spite of it and the density of thrust always decreases properly, because it is physically impossible for a wing to produce a finite density of lift quite close to its end. Still the wing works then under less favorable conditions and with smaller efficiency, and the weight of the propeller and the centrifugal force is unnecessarily great too. Now, the following investigation will show that a gradual decrease of the density of thrust towards the ends is also desirable for other reasons. It is sufficient therefore to keep in mind that the wing tips have to be round, and to consider in the following investigation only the two chief energy losses, the energy absorbed by the air friction and the slip stream loss.

A small variation of the distribution of the thrust hardly changes noticeably the entire loss, especially if the distribution is already close to the best distribution. Hence the problem is less the exact determination of the best distribution of thrust than the derivation of a simple expression which gives quickly an idea as to how the thrust has to be arranged.

The conditions are quite different from those for ordinary wings. There, the inductive losses form a much greater part of the entire losses, and the other part, that is the loss of friction, does not depend on the distribution of the lift at all. Hence, with ordinary wings the distribution of the lift is determined by the consideration of the induced drag exclusively. With the propeller, however, the friction is the dominant part, and both, not only the slip stream loss but the loss of friction too, depend on the distribution of the thrust, for the velocity of the blade elements relative to the air is variable and greater at greater distance from the axis. And whether the ratio lift/drag be constant or not, the ratio of the useful work done by the lift to the energy absorbed by the drag is quite different from it and certainly not constant in general. The useful work is done in the direction of the constant velocity of flight, but the friction is multiplied by the relative velocity of the blade element and the loss is the smaller the smaller the relative velocity is. Therefore the consideration of the friction alone calls for a great density of the thrust near the center. The slip stream loss alone however calls for constant density of the thrust. Hence the smallest loss occurs at a compromise, that is, that the thrust is neither concentrated near the center nor distributed uniformly, but that the density of thrust decreases uniformly towards the outside.

A short calculation will be sufficient to give numerical information on the desirable decrease. Let C_P denote the density of the thrust per unit of the disc area divided by the dynamical pressure of the velocity of flight, that is

$$C_P = \frac{dT}{\dfrac{V^2 \rho\, df}{2}}$$

where dT denotes the infinitesimal thrust acting on the small area df of the propeller disc. C_P may be assumed to be small, say up to .50. Then the slip stream loss originated by this thrust is approximately ¼ C_P multiplied by the useful work done by the same element of thrust. The density of drag measured in the same way is $C_P\, C_D/C_L$ and the work absorbed by this drag is $C_D/C_L\; v/V$ times the useful work, where v denotes the velocity of the blade element relative to the air and V the velocity of flight. For simplicity's sake, I will replace the velocity v by the tangential velocity of the blade element, which is somewhat smaller but not so much that it will greatly injure the final result.

The problem can now be stated in the following way. Let r denote the radius of the blade element, that is, its distance from the axis. The entire thrust is easily found to be

$$(1) \qquad T = 2\pi q \int_0^{D/2} C_P\, r\, dr$$

The slip stream loss for the path of length 1 of the aeroplane can be taken as

$$(2) \qquad 2\pi q \tfrac{1}{4} \int_0^{D/2} C_P^2\, r\, dr$$

The energy absorbed by the friction during the same time is

$$(3) \qquad \frac{(2\pi)^2 q\, n}{V} \int_0^{D/2} \frac{C_D}{C_L} C_P\, r^2\, dr$$

The Coefficient of thrust density C_P variable along the length of the blade, is to be determined in such a way that for a given thrust (1) the sum of the two losses (2) and (3) becomes a minimum.

The solution is extremely easy. It can be seen that by transferring an element of thrust from one place to another the entire loss must not be changed, nor the entire thrust, and hence the ratio of the local change of loss to the change of thrust must be equal to a constant, say λ. The equation which determines the desired function is therefore

$$\delta\,(\lambda\,(1) + (2) + (3)\,) = 0$$

where δ means that the variation originated by any variation of C_P as to form. That is the same condition as if

$$2\pi q \int_0^{D/2} [\tfrac{1}{4} C_P^2\, r + \frac{2\pi n}{V} \frac{C_D}{C_L} C_P\, r^2 + \lambda\, C_P\, r]\, dr$$

is to be made a minimum. The variation is proportional to the integral over

$$\tfrac{1}{2} C_P\, r + \frac{2\pi n}{V} \frac{C_D}{C_L} r^2 + \lambda\, r = 0$$

which then has to be zero at every point r. Hence the solution of the problem is

$$(4) \qquad C_P = 2\lambda - 4 \frac{\pi n}{V} \frac{C_D}{C_L} r$$

It shows, as was to be expected, that the thrust density has to be constant only if the drag coefficient of friction $C_D = O$. But if the friction is taken into account, it is not constant but has to decrease towards the outside. The simplifying assumptions make it appear as a linear function of the radius, and that is just what we wanted, and exactly enough. It remains only to determine the value of the constant from the condition that the entire thrust has a particular value in order to obtain the final expression for the density of thrust. By substituting equation (4) in equation (1) it appears that

$$T = 2\pi q \int_0^{D/2} (2\lambda - \frac{4\pi n}{V} \frac{C_D}{C_L} r)\, r\, dr$$

i. e.,

$$T = 2\pi q \lambda \frac{D^2}{4} - \pi q \frac{\pi n}{3V} \frac{C_L}{C_L} D^3,$$

Hence

$$2\lambda = \frac{T}{\dfrac{D^2 \pi q}{4}} \frac{4}{3} \frac{C_D}{C_L} \cdot \frac{\pi n D}{V}$$

and finally,

$$C_P = \frac{T}{\dfrac{D^2 \pi q}{4}} + \frac{4}{3} \frac{C_D}{C_L} \frac{\pi n D}{V} - 2 \frac{C_D}{C_L} \frac{\pi n \,.\, 2r}{V}$$

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At a radius 2-3 of the greatest radius, the thrust has the mean density, the same that it had to have without friction. At the blade tips, the density has to be

$$(5) \qquad \frac{T}{D^2 \frac{\pi}{4} q} - \frac{2}{3} \frac{C_D}{C_L} \frac{\pi n D}{V}$$

This expression can become negative. But then one essential assumption for the proceeding is no longer valid C_L/C_D is no longer constant but changes its sign. For this reason a negative thrust appears uneconomical in accordance with what everybody expects. Equation (5) becoming negative rather indicates that the diameter has reached its most economical value. This appears, then, to be

$$D^2 = \frac{T V}{n q} \frac{C_L}{C_D} \frac{6}{\pi^2}$$

Let us see now by means of an example, what the derived formulas give for usual conditions. They will give different results for the same propeller under different conditions of flight a reason more why to confine the calculation to a moderate exactness conveniently to obtain.

Illustration:

Diameter 9 ft., that is, disc area 63.5 sq. ft.
n 25 revolutions per second, that is n D = 706 ft/sec.
Thrust 400 lbs.
V 100 mi/hr.
C_L/C_D 22
q 25 lbs/sq. ft. dynamical pressure of flight.

$$D^2 = \frac{400 \cdot 100 \cdot 1.47 \cdot 22.6}{25 \cdot 25 \pi^2} = 1260 \text{ ft}^2.$$

$$D = 10.6 \text{ ft.}$$

That is pretty near to the actual diameter. However, the conditions of great velocity are favorable for a small economical diameter. Suppose on the other hand the velocity of the same propeller to be 60 mi/hr. only and the thrust to be 575 lbs. The dynamical pressure q may be 10 lbs/sq. ft.

Now,

$$D^2 = \frac{575 \cdot 60 \cdot 1.47 \cdot 22.6}{10 \cdot 25 \pi^2} = 2700 \text{ ft}^2.$$

$$D = 14 \text{ ft.}$$

Even in this case, the diameter results only 14 ft., which indicates that the improvement theoretically possible cannot be exceedingly great.

In the first case the mean value of C_P appears .252 and C_P at the blade tip has to be .106. The mean value agrees with the desired value at 2/3 of the radius as always. That is a rather great variability, which corresponds to the fact that the diameter is only slightly smaller than the most economical diameter. In the second example, the mean value of C_P is .90. This is comparatively high and in consequence of it the developed formulas give too large a diameter, for the factor .25 for the induced loss is too high for large values of C_P. Paying no attention to this, the coefficient at the blade tips appears .658. The density is much more constant now, according to the greater predominance of the slip stream loss.

The results obtained are only approximate. The formula for the diameter is not to be considered as a literal prescription. The weight of the propeller is not considered nor the resulting tip velocity, which cannot be increased without limit. Besides, the diameter is more often determined by the general lay-out of the aeroplane. The formula is only to show whether an increase of the diameter means an improvement at all, and to give an indication how much.

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AERO CLUB PENNSYLVANIA

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The stated monthly meeting of the Club was held at the Engineers' Club on the evening of April 24th. It is a source of much gratification to note that the meetings are being more largely attended than ever in the history of the organization. This is undoubtedly due to the excellent program of the meetings and the interesting lectures which the committee on entertainment provide.

Mr. H. L. Goehde, Managing Director of the Municipal Exposition, gave an interesting talk on the Aero Meet which he is planning for Philadelphia, to be held the latter part of May. Liberal prizes and trophies for the events will be offered and if the response is sufficient to guarantee the meet same will be held under the auspices of the Aero Club of Pennsylvania, the officials of which will act as judges for the races and contests.

Mr. Stephen H. Noyes, of the city Bureau of Surveys addressed the meeting on the subject of Municipal Landing Fields and invited the views of the members as to location and proper size of same. Mr. Noyes secured a great deal of data which he proposed to submit to City Council and it is felt that very soon Philadelphia will fall in line with the other progressive cities which have visioned the future and provided air ports for the winged ships of the air.

In connection with the above, the Club is in receipt of blue prints and photographs from the Department of Commerce, Bureau of Standards, Washington, in which Mr. Arthur Halstead, Chairman of Subcommittee on Airdromes and Traffic Rules, invites the Club to submit their comments and criticism of the sizes, markings and dimension of the fields as arrived at by the subcommittee on March 10th.

President Steinmetz has written, in the name of the Club to fully a dozen or more senators. Making an earnest appeal to their patriotic spirit to support the budget for Aviation Research with particular reference to the opportunities of the McCook Field for the reason that aviation research work is the essential working out of commercial aeroplane safety. The letter is a prayer that the appropriation agreement of $3,250,000 for the fiscal year 1922-23 shall stand without any reduction.

Lieutenant Ralph M. Haynes, who served with the British in the World War and who is known as a stunt flier, claims he has established a world's record for tail spinning, as the result of a flight at the Bergdoll Field, Manoa, Pa., on April 24th.

He fell between 9,500 and 9,700 feet in the tail spin. It is claimed the best previous record is 8,500 feet, made at Daytona Beach, Fla., last fall. Haynes carried A. O. Gillette with him as an observer. Gillette is also a stunt flier. They took the plane up to an altitude of 11,500 feet, but could not ascend further because the pump froze. They dropped from that level and righted the plane without difficulty about 2,000 feet from the ground.

The regular monthly meeting for April was held at the Engineers' Club on the evening of April 26th. The members of the Club were thus given the opportunity of a joint session with the Society of American Military Engineers. The speaker of the evening was Major P. E. Van Nostrand of the Training and War Plans Division of the Army Air Service and the topic of the lecture was "Airships and Helium Gas."

The many lantern slides and motion pictures with which the lecture was illustrated were highly interesting and instructive.

It was announced that the Army Air Service is soon to take a series of photographs of Philadelphia and surrounding territory, in co-operation with the joint committee of the Chamber of Commerce and Aero Club of Pennsylvania, for the purpose of a selection of Air Fields for the Sesqui-Centennial of 1926.

The Aero Club of America has appointed Major Charles J. Biddle, Mr. Wallace Kellet and President Steinmetz of the Club as representatives to attend the session of the Academy of Political and Social Science, meeting in Philadelphia, May 12th and 13th.

W. H. SHEAHAN,
1st Vice-President.

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THE VERSATILE AEROPLANE

A great deal has already been written about the versatility of the aeroplane, both in time of war and in time of peace. As an instrument of warfare the aeroplane is a most potent force. The great World War has amply demonstrated this, and the contention that aircraft serve as a first line of offense or defense was proven beyond question during the maneuvers last year at Langley Field, Va., when a number of modern type warships were sent to their watery graves as a result of the accuracy our airmen had acquired in dropping high explosive bombs. As a peace time utility, however, the possibilities of the aeroplane are without limit. Many uses have already been found for it, aside from its principal ues as a means of rapid transportation.

The aeroplane is an engine of destruction in time of war, but it appears to be just the reverse in time of peace. The world is just beginning to realize what a great boon to mankind it really is. For the past several years the Army Air Service has been co-operating with the Forestry Service in an endeavor to suppress the great number of forest fires occurring annually in the vast forested areas of our Great Northwest and in California. Using aeroplanes as a means of patrolling these forests, the observers were able to discover fires practically at their inception, and the prompt reporting of same by radio to headquarters enabled the fire fighters to institute prompt measures to combat them. Thus, the aeroplane has played a most prominent part in conserving the timber resources of the country, and has thereby saved the government vast sums of money.

Fire, however, is not the only destructive force that continually threatens the existence of our forests and orchards. The insect pest is also a power to be reckoned with. Last summer a grove of Catalpa trees near Troy, Ohio, was practically defoliated by the ravages of caterpillars. Here, again, the aeroplane came to the rescue. Flying over this grove and spilling arsenate of lead powder from a hopper attached to the side of the fuselage, the aeroplane accomplished in one minute what could hardly have been accomplished with twenty of the most powerful liquid spraying machines. And the experiment was a pronounced success, the official report on same stating that practically all the insects were exterminated.

The sealing industry, heretofore a rather fluctuating, hit-or-miss sort of a business, and which, for this reason, has been steadily and persistently declining for several past decades, bids fair to recuperate under the ministrations of "Doctor Aeroplane." By reason of the fact that there was no system of intelligence to guide the sealing fleet in its movements, there was always a likelihood that during the night an ice floe carrying the main herd of seals would drift silently by a few miles away and be far over the horizon before the sealers realized the unkind trick Dame Nature played upon them. The occasions upon which the main herd have been missed in this manner have been numerous, and under such circumstances the disappointed sealers were forced to rest content with such crumbs in the form of detached masses of ice carrying a few seals as happened to come their way. The coming of the seal aeroplane has changed all this. Seeking for seal-laden drift ice and maintaining constant wireless communication with the sealing fleet is identical with the spying out of the countryside for the movement of troops in war. The reliability of the flying machine, combined with its radius of action, has rendered it indispensable to the industry.

Out on the Pacific Coast fishermen have utilized the aeroplane in locating schools of fish and leading the boats to large hauls.

As regards the subject of surveying and map making, the aeroplane has already established itself as a practical means of securing quickly, cheaply and accurately, information which can be put to a wide variety of uses in engineering practice. Added to this is the ability of the aeroplane to cover territory inaccessible on foot. Aeroplane photography offers extremely interesting possibilities.

And now we come to a subject that intimately concerns the farmer. Last summer the Bureau of Plant Industry, Department of Agriculture, conducted in a very limited way experiments along the line of collecting from the upper air certain parasites which have been causing different plant diseases. The results they have achieved justify their opinion that a great deal can be learned from a study of the different spores which can thus be collected. The most destruction of this fungi is the black stem rust of wheat, oats, barley, rye and many grasses. An idea of the destructiveness of this parasite may be gained from the fact that in 1916 it caused the destruction of over 200,000,000 bushels of wheat in the United States and Canada—not a very pleasant thing to contemplate either by the farmer or the consumer. It is known that this parasite survives the winter in the north on the common barberry bush which has been used so extensively for hedges. Steps have therefore been taken to eradicate this particular plant on this account. The theory is advanced that these spores are developed in the south and are carried north into the wheat regions by the air currents. Dr. Stakman of the Bureau of Plant Industry, Department of Agriculture, under the direct supervision of Dr. Kellermann, Associate Chief of the Bureau of Plant Industry, in co-operation with representatives of the Engineering Division at McCook Field, Dayton, Ohio, is conducting certain experiments in this connection, and there is now being designed an efficient type of spore trap which will contain several common laboratory slides, the faces of which slides will be covered with a gelatinous matter or vaseline. These spore traps will be placed on aeroplanes and will be so arranged that different slides may be exposed at different elevations in the air. It is anticipated that the air blowing against these slides will result in there being collected on them whatever fungi there may be present in the air in that particular region. A simple laboratory test will serve to identify the various classes of fungi spores which may be collected.

Representatives of the Department of Agriculture will conduct these tests during the spring and summer at Kelly Field, San Antonio, Texas; Chanute Field, Rantoul, Ill.; Fort Riley, Kansas; Post Field, Fort Sill, Okla.; and Camp Knox, Ky. These spore traps will be installed on a great number of aeroplanes during the course of their numerous flights, and a careful record will be kept of the results obtained. At the end of the season a compilation of the results will enable the Bureau of Plant Industry in Washington to arrive at some definite conclusion in regard to this plant disease, and the Department of Agriculture may then be able to devise the neessary measures to combat, if not entirely eradicate, this highly destructive plant disease.

Just recently aeroplane pilots from Carlstrom Field, Arcadia, Fla., co-operated with the well known scientist, Dr. David Todd, Professor of Astronomy and Navigation, in a rather interesting experiment at Miami, Fla. Moving pictures were taken of the sun from an aeroplane at altitudes of 16,000 and 17,000 feet. The idea of taking the pictures from such altitudes was to get away from the dust particles in the atmosphere near the earth's surface. Professor Todd expects to gather some very interesting data from these films.

The other day the Netherlands Aircraft Mfg. Co. sent us a communication stating that it is reported from Holland that exceptionally severe weather would have imposed great hardships upon the inhabitants of the many islands which lie to the north of the Dutch mainland were it not for the timely assistance rendered by the big Fokker aeroplanes of the Royal Dutch Air Service Company. All boat traffic having ceased owing to the ice, the aeroplanes were used to deliver large quantities of food and other supplies to the islands.

The foregoing enumerates only a few of the many uses which have been made of the aeroplane, which can be truly classed as the most wonderful invention of the age. Can anyone stretch his imagination far enough to say to what further use the versatile aeroplane will be put in the near future? Certainly, the aeroplane has come to stay, but it deserves far greater recognition and much better treatment than that which has so far been accorded it.

AEROPLANES USED IN EXPERIMENTAL WORK IN THE STUDY OF RUST SPORES

E. H. Ostrom, field assistant in cereal investigation of the U. S. department of agriculture, has arrived in Lawton, Okla., for the purpose of conducting a series of experiments requiring the use of aeroplanes. Mr. Ostrom is a graduate of the College of Agriculture of the University of Minnesota.

The war department is cooperating with the department of agriculture in these experiments and in the work which he plans in this vicinity Mr. Ostrom is receiving cooperation from Post Field officials.

Mr. Ostrom explains the nature of the experiments, which will be of incalculable value to agriculturists, in the following:

"As long as 200 years ago plant diseases have been traced from their source for a distance of several miles. It is therefore an established fact that plant diseases travel from one field to another carried by the wind, also that diseases which show up in some small area of the county in time spread so as to cover the whole of that county.

"It is also considered probable that it may travel to adjoining states or even further, but definite data is lacking.

"The black stem rust and other rusts are fungi, a form of plant life, very much re-

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Where Wright Aeronautical Engines Are Made

ACREAGE Approximately 7 acres, located on Main Line of Erie Railroad.

AREA 90,000 square feet.

DESCRIPTION Four floors, size 75 ft. by 300 ft. Concrete and steel heavy mill type construction, 250 pounds per square foot loading.

EQUIPMENT The plant is equipped at present to produce, and is producing approximately 300 engines per year, with spare parts therefor, and has ample capacity in addition to provide adequately for all spare part requirements for all types of engines previously produced. The equipment of the plant provides for the complete manufacture of various type engines produced, including bronze and aluminum castings, except bar steel and drop forgings. The capacity of the present plant could be expanded to produce engines at the rate of five per day in the present building. In an emergency the present acreage would allow of enough additional buildings and equipment being provided within six to eight months to produce engines of any one type in quantities of at least 25 per day.

The plant has employed during the past year an average of 450 people, which includes a complete Engineering Department and Experimental Shop.

WRIGHT AERONAUTICAL CORPORATION
Paterson, New Jersey, U. S. A.

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sembling bread mould. The reproductive units, which correspond to seeds of plants, are known as spores. These spores are too small to be seen with the naked eye, but when grouped together by the thousands as they are found on the wheat plant, they are visible as a pustule of rust.

"When the rust matures the spores are blown off and picked up by the wind and carried to other fields, thus spreading the disease. They alight on the growing grain, germinate and get inside the plant tissues, growing and branching so as to form a good root system; then as soon as weather conditions are favorable for the development of the disease, they grow rapidly, mature and burst through the epidermis, and we have rust on the plant.

"Lice do not have good pickings on a starving dog. Neither does the rust thrive on a drought-stricken wheat plant. When the wheat plant is growing most vigorously, when the sap is rushing up to nourish and fill the wheat head, then the rust develops most rapidly, sucking the sap which should fill the head. The result is light bundles, low yield and shriveled kernels.

"The black stem rust presents a problem. To fight it we must know definitely how and when it travels. In the states north of Kansas, Missouri and Tennessee, the common or Barberry bush rusts early in the spring and spreads the black rust in its own territory. Barberry bushes do not rust in the south. In Texas and Mexico, the rust lives over winter on the winter wheat and on grasses, and the prevailing winds spread it around.

"The Daily Oklahoman on Monday, April 24, contains an article which creates the impression that army planes are to be used in spraying or dusting the wheat fields. This is incorrect, for there is no such intention.

"What we want is to determine how high the spores are carried upwards and at what altitudes they are most abundant; to learn at what time they appear in the air in different parts of the country; to find out the reaction of the spores to temperature, humidity, precipitation, ascending and descending air currents, velocity and direction of prevailing winds and any other meteorological data which may become available.

"Spore traps have been designed to catch these spores on glass slides coated with a thin layer of vaseline to which they stick.

"One or more altitude flights are planned during which a standardized thermometer will be used to record the temperatures at the various altitudes at which the exposures are made.

"Major Lohman, assistant commandant of Post Field, in explaining the whole hearted interest of the air service in these experiments said: 'You have my permission to fly from 8 a. m. to 4 p.m. every day in the week.' This gives me the opportunity to choose the most desirable time for each flight.

"Cross-country flights will be made to such cities as Liberal, Kan., Denver, Colo., Lincoln, Neb., St. Louis, Mo., Dallas, Tex., etc. Slides are to be exposed at points separated about 50 to 100 miles along the route, as well as at each of the destinations. This, then, permits of a fairly representative area being covered.

"After exposure these slides will be sent to the Minnesota Agricultural Experiment station for examination. Messrs. Christensen and Lambert, pathologists, at Minnesota, are to make the spore counts and will also make attempts to germinate the spores.

"Mr. G. C. Curran, state leader for Barberry eradication work in Illinois, will make flights from Chanute Field, and Wallace Butler, botanist at San Antonio, from Kelly Field.

"Dr. E. C. Stakman, chief of the division of plant pathology at Minnesota, is the guiding genius for the whole work."

Back Pay for Former Flying Cadet Awarded

The Court of Claims of the United States made a decision on February 27, 1922, stating that Nelson W. Rider, formerly flying cadet, United States Army, was entitled to $306.82 back pay, incurred when the pay of flying cadets was cut from $100 per month with 50 percent increase for flight duty to $33 per month plus 50 percent thereon for flight duty. This cut was made about the first of July, 1918.

Following is an extract from the decision of the Court of Claims: "The Government contends that the provision of the act of June 15, 1917, which established the pay of the plaintiff at $100 per month expired with the expiration of the appropriations set forth in the act. We are of the opinion that this contention is not tenable because of the provisions of the act of July 24, 1917, and of the act of July 9, 1918, which latter act makes available the appropriations of the act of July 24, 1917, and of the appropriations of the act of May 12, 1917, until June 30, 1919. Nor does it anywhere appear that there was any intention to repeal the provisions fixing the pay of enlisted men in training for officers of the Reserve Corps. It is hardly possible to conceive that Congress would at the height of the emergency, while the war was going on, reduce the pay which had been held forth as an inducement to the young men of the country to enter into training for officers in the Reserve Corps."

The Government has 90 days from February 27, 1922, in which to make an appeal. If this is not done within the allotted time, the decision holds.

Aerial Age has received several inquiries as to whether it will be necessary to file suit against the Government and obtain the services of an attorney to get back pay. This is not necessary. Former flying cadets should file their claims with the Comptroller General, War Department, Washington, D. C., and if the decision is upheld they should receive back pay due them.

Reserve Corps Activities in Oklahoma

Prior to the arrival of an Air Service officer for duty with the 95th Division, U. S. Army, the headquarters of which is Oklahoma City, Major J. C. King, Cavalry, A. C. of S. (G-1), began the organization of the 320th Squadron (Observation) 95th Division. At the present time Captain Louis D. Abney, A. S., O. R. C., Oklahoma City, the senior officer of the squadron, is due for promotion, and will, by virtue of his rank and experience, command the squadron.

In order to get the "right man in the right place" in the squadron, the Air Service officer with the Division is getting from all listed Air Service Reserve officers in his territory a tabulated statement of their air experience. It was found that this information was not definite enough under the heading "Chronological Statement of Military Service" on the reserve officers' qualification cards.

The headquarters of the Air Service of the 95th Division is at Muskogee, where the Air Service officer with the Division (now at Oklahoma City) will be located after April 1st. The headquarters of the 320th Squadron is at Oklahoma City.

It may be of interest to set forth the allocation of Air Service units to the State of Oklahoma:

The *first priority* for organization in the State of Oklahoma is:

Division Troops
95th Division, A. S. Hqrs......Muskogee
320th Squadron (Obs.)....Oklahoma City
320th Photo Section..............Tulsa
Branch Intelligence Office, A. S., 95th Div., not allocated.

Second Priority:
Army Troops, III Field Army
321st Air Service Attack Group, Hqrs., Enid
472nd Air Service Attack Squadron, Enid
473rd Air Service Attack Squadron, Enid
474th Air Service Attack Squadron, Enid
350th Air Park ....Enid
431st Photo Section................Enid

Third Priority:
XVIIIth Corps Troops—VI Feld Army.
365th Squadron (Obs.) ....Tulsa
365th Photo Section......Oklahoma City
329th Balloon Company...Oklahoma City
108th Communications Section ....Oklahoma City

As soon as the Division Air Service is completely organized and capable of functioning in case of mobilization for an emergency, the second priority organization, and then the third will be started.

Outside of the regular Air Service garrison at Post Field, there are no other Federal Air Service activities in the State beyond what has been above mentioned.

The Aviation Committee of the Chamber of Commerce of Oklahoma City is a wide-awake organization. They are actively on the lookout for better airdrome facilities than now possessed at Needham Field. They realize the great future of aviation and are anxious to have Oklahoma City on the air map.

This same committee is forming the nucleus of a National Guard Squadron for the State, with the idea that they may get flying training, which they must have before being eligible for appointment as Reserve Officers.

Development of Model Airway

Under instructions recently received from the Chief of Air Service, First Lieutenant Clarence E. Crumrine, A. S., has been detailed on duty to investigate the route of the Model Airway from Mitchel Field, L. I., New York, to Pine Valley Field, N. J. This work includes the making of standard sketches and the completion of questionnaires on all intermediate fields, together with the taking of oblique photographs. These fields and following points are being investigated, sketched and photographed:

Valley Stream, L. I.; Belmont Park, L. I.; Sheepshead Bay, New Dorp, Staten Island; Freehold, New Jersey: Prospertown, New Jersey; Camp Dix, New Jersey; Medford, New Jersey; Sandy Hook, New Jersey.

Work on the development of this air route has already begun. It has been delayed due to inclement weather but will be now pushed to rapid completion.

Progress of the Air Service Mechanics School

The Air Service Mechanics School at Chanute Field, Rantoul, Ill., is functioning in every department. There are now 496 students actually undergoing instruction, and 225 awaiting instruction. The first class of men who were enlisted in the recent recruiting campaign will be graduated on May 12, 1922. It will consist of twelve armorers. Following this comes a class of five blacksmiths, who will complete the course on May 26th, and the following classes on June 9, 1922: Armorers, 12; fabric workers, 4; mechanics, airplane, 13; mechanics, airplane engine, 14; mechanics, auto, 14; machinists, 5.

The next class will graduate on June 26, 1922 and classes will follow throughout the year at periods of two weeks.

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NAVAL and MILITARY AERONAUTICS

Night Flying in the Philippines

Lieut. R. Baez, Jr., gave the garrison at Clark Field, Pampanga, P. I., and not a few visitors, a thrill on Friday night, February 17th, when he made a night flight for the purpose of testing out the new flood lights recently installed on the hangars for emergency use. Lieut. Baez remained in the air for an hour, during which time he flew over the encampment of troops located several miles northeast of the field and Camp Stotsenburg proper. A perfect landing was effected, but due to the rough field a shock absorber was broken, without mishap, however.

Agricultural Experiments at Kelly Field

Prof. J. G. Butler, of the Department of Agriculture, made flights on March 27th and April 1st, from Kelly Field, with Lieut. F. P. Booker as pilot, in connection with some experiments he is conducting with a view to determining the origin of the spore of wheat rust in this country. The flight on March 27th was made in a DH4-B and the one on April 1st in a JN6H. It is the belief of the officials of the Agricultural Department that the spore of this parasite travels in the upper air from Mexico, and possibly Central and South America. Plates with a mucus substance on one side are mounted on a rack on the wing, and by shutter arrangement are exposed from a control in the rear seat, whenever desired. Exposures were made at every 500 feet up to 3,500 feet with much success. In this experiment the JN6H was more satisfactory than the DH4B, the air stream of which prevented the shutters from closing again.

Aviation Activities in Massachusetts

There is every likelihood that a landing field will be established in the City of Boston, if the efforts of a progressive organization like the 101st Aero Squadron, Massachusetts National Guard, count for anything. This squadron was federally recognized November 18, 1921, and was inspected for permanent federal recognition March 3, 1922. Rooms have been assigned to house the squadron at the South Armory, Boston, and a drill period is held there every Friday night from 7:30 to 9:30 p. m. Some of the officers and non-coms give Monday evenings to squadron affairs, and spend other time at the armory also.

Of the commissioned personnel of the squadron, the following have been assigned to regular duties: Major Charles H. Woolley, Commanding Officer; 2nd Lt. L. E. Boutwell, Adjutant and Supply Officer; 2nd Lt. H. N. Carlson, Engineer Officer and Officer in Charge of Instruction.

The strength of the squadron on April 8th was 12 officers and 67 enlisted men. The officers enumerated above are the only ones so far assigned to special duties. Non-commissioned officers have been appointed to act as such until June 1st, when examinations will be held for permanent appointments.

Under the direction of Lieut. Carlson, a schedule of instruction has been prepared and closely followed. Assembly is at 8 p. m. About half of each period is given over to basic training, such as infantry drill on the armory floor. The remainder is devoted to technical training. The enlisted men have been divided into sections for technical training, each section pursuing its assigned specialty of rigging, engines, ordnance, etc. Usually, on alternate Fridays the sections meet as a whole for a group lecture, the squadron being especially fortunate in having secured the voluntary services of Prof. E. P. Warner, of the Dept. of Aeronautical Engineering, Massachusetts Institute of Technology, who is delivering regularly a series of lectures to them.

Aside from uniforms, office furniture, and a few items of school equipment, the organization is still unequipped to function as a squadron. Its requisitions for flying equipment may be approved, but deliveries must wait until the State provides an aerodrome. Until then the flying activities of the squadron will be confined to occasional hops by some of the officers in planes of the A. S. Detachment of Framingham.

The problem of securing a landing field and suitable housing facilities for its equipment is the chief concern of the squadron today. It has combined efforts with the Corps Area Headquarters, the Chamber of Commerce of Boston, and the various aero clubs and interested individuals who are behind a bill now before the State Legislature which provides for the construction of a municipal landing field in East Boston which is to be leased for a ten year period to the Federal government for a nominal rental, the field to be used jointly by military and civilian planes, though under Federal supervision. The bill specifies an expenditure by the State of $35,000.00 to level and prepare the runways. Ground adjacent to that leased to the Army is to be leased to civilian and commercial fliers for hangars and shops, and it is hoped that the establishment of this field will lead to the extension of the transcontinental Air Mail service from New York to Boston. The proposed field is within two miles of the Boston Post Office. This East Boston site has exceptionally favorable characteristics for a municipal aerodrome from the standpoint of convenience of location, freedom on all sides from obstructions, availability (the whole property is state-owned and at present is lying idle,) and its conspicuous position in the harbor making it easy to locate from the air. In addition, being surrounded on three sides by water, it will be available for seaplanes.

The landing field bill has been favorably reported by the Committee on Public Lands. It is now before the Joint Committee of Ways and Means. One hearing has been held. The latest advice concerning its progress in this Committee is to the effect that they are waitng for a definite proposal from the War Department stating exactly what the Army will furnish this aerodrome in the event that the bill is passed, and exactly what the cost will be to install and maintain hangars and shops, etc., for the National Guard. When the Committee receives more definite figures concerning the State's share of the expense, it will undoubtedly come to a decision on the bill. The present indications are against an early report in favor of the bill should the Committee find out that the State will have to spend much more than the $35,000 first asked for to be spent on the runways.

With regard to the social activities of the squadron, the Aero Club of Massachusetts gave a ball on February 24th, and donated half of the proceeds to the squadron fund. This donation amounted to $638.26, and some contributions by the officers added to this has given the squadron fund a good start. This fund has been tapped to pay for coffee mugs, books, extra clerical work, and small administrative expenses. It is expected that the splendid interest and morale so far manifested by the personnel will increase with the approach of summer weather and lead to more social activities such as help to weld the organization into a "regular" body fostering good fellowship and loyal pride in themselves and in the army.

Athletics of some sort, including a baseball team, are contemplated for early inauguration.

Airplane Formation Greets New Department Commander

In preparation for the arrival of the new Philippine Department Commander, Major W. M. Wright, who sailed from the States on the Transport *Thomas*, arrangements were made for an eleven-plane formation to escort the *Thomas* to her dock. Five planes were flown to Paranaque Beach, Manila, on the morning of March 3rd, the pilots of these planes being flown back to Clark Field in the afternoon by pilots from Camp Nichols. At 6:45 a. m., March 6th, a five-plane formation took off from Clark Field and flew to Manila Bay, where they were joined by the formation from Paranaque Beach. They flew to meet the *Thomas* and escorted her to the pier.

A Bombing Record at Aberdeen, Md.

The best bombing record for the Aberdeen Proving Grounds, Md., was made on April 6th, when, with First Lieut. Max F. Moyer, A. S., and Master Sergeant William F. Fitch, Air Service, as pilots, and Captain S. R. Stribbling, Ordnance Department, as bomber, a total of seven hits out of eight bombs dropped was recorded. The bombs were dropped from an altitude of 2,000 feet on the "Hard Surface," a concrete block, 200 feet by 200 feet. The eighth bomb missed the target by approximately two feet. During the week ending April 8th a total of 2,600 pounds of bombs were dropped from the Airship C-2 on the "Hard Surface".

Test of Sperry Gyro Compass

A special flight was made at the Aberdeen Proving Grounds on April 3rd with a Sperry Gyro compass. With Mr. J. A. Fitz, of the Sperry Company, conducting the test on the compass, a triangular course was flown from Aberdeen to Belair, to Havre de Grace and return to Aberdeen. The performance of the compass on this short run was very satisfactory.

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FOREIGN NEWS

French Air Mail

In connection with the report on French commercial aviation activities published in Commerce Reports of January 23, 1922, recent figures are interesting as showing a considerable increase in the use of the aerial postal service between Toulouse and Casablanca. During October, 1921, 40,600 letters, weighing 1,560 lbs., were carried between the points named as against 24,850, weighing 870 lbs., in October, 1920. A saving of five days in transmission of mail accounts for the popularity of the air route. During the year ending September 30, 1921, the mail matter carried by this service consisted of 306,181 pieces out of a total of 351,742 pieces carried by all aerial routes between France and foreign countries. Of the figures given, the Paris-London service transported 28,534 pieces, the remainder being carried by the services from Paris to Brussels, Amsterdam, Prague and Warsaw.

Egyptian Air Mail

The aerial mail route established between Cairo and Bagdad has been extended to include Palestine. A regular fortnightly service will be maintained in each direction.

German Aeronautics

The Director of the "Aero Union," a German Aircraft Corporation, with headquarters in Berlin, which controls and operates the "Deutsche Luftreederei," a German Air Traffic Company, announced recently that his company has made arrangements to establish an aircraft factory near Pisa, Italy, and that the production of all-metal Duraluminum aeroplanes is expected in May or June, 1922. The raw material for these airplanes will be shipped from Germany and worked up and assembled in Italy by German and Italian workmen. The "Aero Union" was organized a few months ago, and is controlled by a combination of the "Allgemeine Elektricitats Gesellschaft" (the General Electric Company of Germany), the Hamburg-American shipping interests, and the Zeppelin Aircraft interests.

Announcement has also been made that the "Aero Union," in cooperation with the Russian Government, has organized a company under the name of "German Russian Air Transportation Company." The company hopes in the Spring of this year to organize a regular air service between Germany and Russia with passenger airplanes of the Russian Government, temporarily on the stretch between Konigsberg-Moscow, in close connection with the Berlin Evening Express and return. The preparations for this are being directed by German and Russian technical experts. The service will primarily be for the purpose of transmitting official courier mail matter from Berlin to Moscow and Moscow to Berlin, as well as passenger and light freight service.

Progress in England

The promotion of a great flying festival at the London Air Station, Croydon, is a matter that is engaging the attention of the Air Ministry, Aircraft Constructors, Aero Club, Aeronautical Society and Air League. The festival is to last a week, will probably take place early in 1923, and is being designed to fasten attention on flying in a way that has hitherto not been found possible. The main feature of the festival will be an exhibition of every type of modern flying machine, including, it is hoped, helicopters. Concurrently, an international congress on air problems will be held, and speed and duration tests organized and decided. An effort is also being made to arrange that the Royal Air Force annual pageant shall be held at Croydon during the week.

In order to speed up the delivery of goods to Paris from Manchester or other provincial towns in England, a night aeroplane service will shortly be inaugurated whereby parcels dispatched by passenger train after business hours from these towns will be collected by a special motor van from the London Railway Terminal between midnight and 1:00 a.m., and immediately thereafter put on board the night express leaving the London airdrome at 2:30 a.m., and scheduled to arrive at Paris at about 5:00 a.m. Upon arrival in Paris the goods will, by special arrangement, be passed through the French customs and delivered by motor van in Paris as soon as business houses are open. A similar arrangement is to be instituted in connection with goods from provincial towns in France consigned to London, an air express leaving Paris early in the morning and parcels sent from, say, Lyons or Lille, after business hours one evening will be delivered in London the following morning, or in Manchester or other towns by the afternoon.

The night expresses which are now being built will be equipped with instruments and navigation lights for night flying, and this, in conjunction with the illumination of the London to Paris Airway, soon to be completed, will make night flying a safe and regular operation.

With the opening on April 3rd of the new Paris-London Aerial Company, known as the Daimler Airway, the number of British companies operating regularly between London and Paris has been raised to three, the other two being the Instone Air Line and the Handley Page Co. The new company will use the latest type of D. H. machine, known as D. H. 44, and will run a daily service in each direction. There are also two French companies working on the route. Even at this time of the year a regular flow of passengers continues, most of them being American and English family parties on holiday.

Rotterdam-Copenhagen Service

According to FLIGHT (London) arrangements have been made for inaugurating an air mail service between Rotterdam and Copenhagen. The company which is to undertake the new service is stated to be Danish, although it is intended to use British machines and pilots. The plan is to have machines leaving Rotterdam in the morning, after the arrival of the night boat from London, and it is expected that they will be able to reach Copenhagen shortly after noon, so that the mails should be distributed early in the afternoon in that city. In the opposite direction machines will leave Copenhagen at 3:00 p.m., and will reach Rotterdam in time to connect with the night boat to London. Thus, instead of taking 72 hours, the mails between London and Copenhagen should do the journey in about 24 hours.

Netherland Activities

The Royal Aerial Navigation Co. of the Netherlands carried during 1921 a total of 1,548 metric tons of mail, 36,634 metric tons of freight and 1,674 passengers. The Amsterdam-London line accounted for more than half of the mail and merchandise, carrying 844 tons of the former and 24,875 tons of the latter. In 1921, 931 passengers traveled on the Amsterdam-Brussels-Paris line and 254 on the Rotterdam-Hamburg line. These figures indicate a marked increase over the 1920 volume of traffic, which totalled only 3 tons of mail, 22 tons of freight and 345 passengers.

French-Italian Race

The greatest of many attractions at the aviation meeting held at Nice this Spring was a speed contest between two of the fastest aeroplanes in the world. Sadi-Lecointe, the French champion, met Brack-Papa, the famous Italian flyer, the Frenchman being on a small, speedy Nieuport scout plane, while the Italian had a high-speed Fiat bombardment aeroplane driven by a Fiat 12-cylinder, 700-h.p. engine.

The two championa were very closely matched. At the outset of the aerial race Brack-Papa got a slight lead and maintained it to the end, for he covered the course on his Fiat in 9 min. 42 3/5 seconds, compared with 9 min. 50 seconds for Sadi-Lecointe's Nieuport. The speed of the planes was about 190 miles an hour.

Durban Aerodrome

The work of filling in and leveling the ground on the Eastern Vlei near Durban, set aside for an aerodrome, has now been completed, but nothing else has been done, and it will be left to private enterprise to concert the area into a suitable flying ground, reports the *Natal Mercury*. All the municipality was concerned with was the setting aside and levelling of the area. At present there does not seem much chance of a rush of applicants for accommodation, as there has been no flying in Natal for some time, but the Town Council were right in preparing an aerodrome, as commercial flying has come to stay, and in the near future South Africa will have to fall into line with other countries in adopting and encouraging aviation.

Germany Will Extend Commercial Air Lines

German commercial aviation circles are making extensive plans to resume and extend international air service when the Allies, as announced, remove their military control May 5. Prior to this the Germans could not establish international lines. Some companies evaded the interallied control by establishing companies in other countries, notably Holland.

A scheme has been perfected for a Berlin, Danzig, Kovno, Moscow line. Another German company plans to extend its service across Russia to Pekin this year. Inside of Germany there has been an increase recently in the number of air lines. The Hamburg-Amsterdam lines have been closed down, but toward the east there is the line to Stuttgart which was established recently. Airplane service between Munich and Constance has been resumed. There is a new line between Bremen and Dresden and during the summer aeroplane traffio between Berlin and Hamburg and north and Baltic resorts will be resumed. The Government is not now supporting commercial aviation, but German big industry stands behind German aviation.

Aircraft in Chinese War

The forces of Sun Yat Sen, head of the South Chinese Government at Canton, have captured the entire Southern Naval Squadron, it was stated in unofficial despatches published by the foreign and Chinese press.

The squadron captured, although containing some of the most important Chinese war vessels, amounts to little from a naval standpoint, authorities agree. The ships captured, reports stated, include the cruiser Hai Chi, the largest vessel in the Chinese Navy, but of only 4300 tons displacement; the cruiser Hai Chen, the gunboats Chu Yu, Yung Peng, Yu Chang, Yung Shan, Fei Ying and Yun Yan, the training ship Chao Ho and the transport Fu An.

The attack on the vessels which resulted in their surrender was carried out by aircraft in conjunction with South Chinese troops. The aircraft bombed the vessels in the Pearl River, twenty men being killed and thirty others wounded on board the cruiser Hai Chi in the initial attack, the reports state.

Later there was a further bombing attack on the vessels near Canton, in the Whampoa River, the Hai Chi and other craft surrendering.

(*Concluded from page* 219)

performance are taken to a laboratory, greatly enlarged for study, and then plotted on a single sheet so that a complete story of the particular flight or manoeuvre is ready for analysis.'

The instruments developed have been employed at the free flight laboratory of the National Advisory Committee for Aeronautics at Hampton, Va., by Test Pilot Thomas Carroll, in studying ordinary and "stunting" manoeuvring, including looping, rolling, the so-called Immelman turn and reverse turn. An extensive study of landing and taking off has also been made.

In his report on the tests, Pilot Carroll emphasized the importance of "taking off" and "landing," which are the dominating factors of the efficiency, and perhaps the longevity, of a pilot. Of the two, he says, landing is perhaps the more important, for it is in this phase that the majority of accidents and damages occur. A paper on "taking off" and "landing," by Major R. M. Hill, a British flying officer, is the only one known to have been published on these important manoeuvres, and it was this treatise that inspired the tests and developments undertaken by the National Advisory Committee for Aeronautics in this country.

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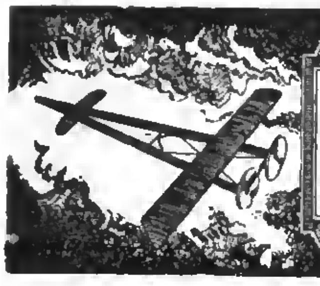
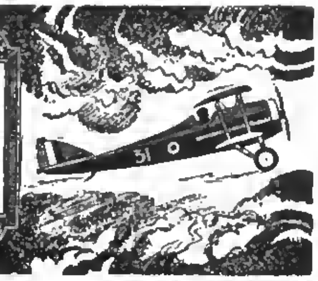


ELEMENTARY AERONAUTICS *and* MODEL NOTES



Scale Model Built by Aerial Age Reader

Douglas Young, of Westboro, Ontario, a veteran model builder and a member of the Flight Association of Ottawa, Canada, his completed a neat model of the Newport Chasse plane. This model is complete with all controls, bucket seat, turnbuckles, dummy rotary engine with cooling flanges, exhaust pipes, push rods, etc. The propeller, machine gun, etc., are all to scale and all details such as the instrument board, sprung chassis, etc., are carefully formed to correct proportions.

The finish is of aluminum color, with the red, white and blue insignias and rudder markings of the French Army Air Service.

The scale is one-tenth full size, the wing span being reduced in this proportion to approximately 32 inches.

Hydro Models Giving Good Performance

SGT. Joseph S. Ott, of College Station, Texas, whose extensive work on model aeroplanes has been mentioned in these columns before, gives an instructive description of one of his successful models, a 21-inch hydro which will fly 400 to 500 feet, rising from the surface of the water. This tractor model leaves the water after skimming the surface for only about 5 to 6 feet, is very dependable in its performance and never fails to take of properly.

The specifications of the Ott 2½-inch hydro model are as follows:

Wing span	21 inches
Wing chord	3½ inches
Weight	.97 ounce
Propeller diameter	7 inches
Propeller pitch	5 inches
Power—(elastic, 3-16 inch flat)	3 strands

The motor stick is 3-16 inch by 3-32 inch, with a ring located at the middle to support the rubber power in position. By this arrangement the propeller may be turned 800 revolutions without danger of twisting the frame too greatly.

A block of white pine ¼ inch by ½ inch is used for the propeller blank.

Floats are 1½ inches wide, ¾ inch deep and 4 inches long. The frame is built up of strips measuring 1-32 inch by a little less than 1-16 inch in section.

The wing has a pronounced dihedral which decreases the actual span to 21 inches, although the wing measures 24 inches in flat plan. There are seven bamboo ribs attached at each end to white pine spars 3-32 inch by slightly less than 3-16 inch.

Horizontal stabilizer measures 3½ inches in length and 4½ inches in width. Thread is used for the edges, completely around. A triangular jin aft of the stabilizer measures 2 inches in height and 3 inches in length.

Another of the Ott hydro models giving good performances is the little twin-pusher having a 26-inch wing span. Its weight is very low; a trifle less than 1¾ ounces. The specifications are as follows:

Wing span	26 inches
Wing chord	4 inches
Weight	1.74 ounces
Propeller diameter	7 inches
Propeller pitch	7 inches
Power—(elastic, 3-16 inch flat)	3 strands

The A frame is 26 inches long, ¼ inch by 1-16 inch in the center and tapering to 3-16 inch by 1-16 inch at the ends. Cross braces are 3-32 inch by 3-64 inch, using two X pieces and 3 straight members.

Hook and shafts for the propellers are of number 14 piano wire. There are two propellers, turning in opposite directions, to counteract against torque or twisting. The propeller blanks are cut from blanks of white pine ½ inch thick and ¾ inch wide.

Main wing frame is of pine. Diamond or pointed tips of bamboo. Seven ribs, 1-32 inch by 1-16 inch are used. Covering on the top surface only.

The elevator is 12 inches in span, 2½ inches wide. Bamboo construction throughout. No elevating blocks are used, but the elevator wing tips are bent upward about ½ inch to give the required lifting angle.

Chassis members are a trifle under 1-16 inch square.

There are two floats at the front and one at the rear of the frame. Front floats are 4 inches long, 1¾ inches wide and ¾ inch deep, coming to a point at front and rear. They are patterned after the shape of a snow shoe. Rear float 5 inches long, 2 inches wide and ¾ inch deep.

Two coats of Shellac are applied to the framework and wings to render them as completely waterproof as possible.

The elastic motor takes 950 turns and it is powerful enough to take the model off in a moment. By decreasing the angle of the front floats, the model will run over the surface for about 6 or 7 feet before taking off. Landings are made in perfect balance.

Best results are obtained when the main wing is located about ½ inch behind the center of gravity. This permits the model to assume a very flat glide when the power has been used up. Better gliding is also accomplished by a gradual decrease in the incidence or lifting angle of the elevator plane, altho if sufficient lift is not obtained, the model will not leave the water quickly and the duration of the flight will be decreased.

Flights of 800 feet are made with the 26-inch model, starting from the water under its own power.

Mr. Ott has designed quite a variety of models, from small tractors to compressed air types, and the details of some of the more popular types will be published in forthcoming issues of AERIAL AGE.

Hydro models designed by Sgt. J. S. Ott, U. S. Air Service. At the right is a 26" twin pusher. At the left a 21" tractor which will fly 500 feet

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RADIO DIGEST

New York Mayor Requests Radio Appropriation

The special Radio Committee appointed by Mayor Hylan of New York City about a month ago decided to recommend the erection of a city broadcasting station on top of the Municipal Building.

The station is to cost $50,000, and its erection is to be under the supervision of the Department of Plant and Structures. The Board of Estimate will be asked by the committee to appropriate the sum at its meeting Friday.

The meeting was held in the office of Rodman Wanamaker, Special Deputy Police Commissioner, one of the members of the committee, with these other members in attendance: Borough President of Queens Connolly, Commissioner of Plant and Structures Whalen, Col. Barrett Smith of the Department of Water Supply, Arthur S. Tuttle, chief engineer of the Board of Estimate, and City Chamberlain Berolzheimer.

The appropriation covers not alone the broadcasting station, but many portable receiving stations that may be set up quickly in parks and other places where crowds gather—these receiving stations to have sufficient amplifying apparatus to carry to every ear in a multitude.

When the station is going, and the Mayor or one of the department heads wants to say something without using the medium of the public prints—presto! He calls for his radio crew, orders the receiving sets put up in all the boroughs, talks into the mouthpiece of his office telephone and the people will hear his own words in his own voice.

All the important orders and directions of the Fire, Health and Police Departments are to be broadcast from the Municipal Station. Whenever a distinguished visitor from abroad calls to pay his respects to the Mayor, the freedom of the broadcasting chamber is to be conferred upon him, so that the feted stranger may address not only a populace of newsboys in front of City Hall steps, but many thousands of citizens elsewhere.

Lest the appropriation be regarded as an extravagance, in view of the many broadcasting stations now keeping citizens listening close to home, this economy feature was mentioned, with suitable cheers, at the committee's meeting:

Music is to be supplied to parks through the municipal broadcasting station.

One band will do for all parks!

One really good band may be hired instead of several lesser bands.

The amplifying apparatus will do the trick.

Radio Tests at Camp Vail

Captain Clyde V. Finter, A. S., left for Camp Vail, April 10, 1922, under orders from the Chief of Air Service for the purpose of co-operating with that station in the development and testing of radio apparatus. This work will occupy about ten days. The plane which Captain Finter flew from Mitchel Field was equipped with the most modern type of radio sending apparatus. Mitchel Field was continuously in touch with Camp Vail by radio telephone during the period of these tests.

New Radio Station at Aberdeen, Md.

A new radio station has been opened at the Airship Field, Aberdeen Proving Grounds, with an S. C. R. 109 set as the main operating equipment. A wave length of 850 meters has been assigned this set by the Signal Officer of the 3rd Corps Area.

National Guard Unit Will Give Weekly Radio Concerts

The following statement has been issued by the Signal Corps of the National Guard of New York.

"The commanding officer of the 101st Signal Battalion, N. Y. N. G., realizing the tremendous interest aroused by the broadcasting of radio music and news, has authorized the institution of a series of radio concerts, to be held at the Signal Corps Amory, Park Avenue and Thirty-fourth Street, on Wednesday evening of every week.

"Such complete equipment as is necessary will be utilized to reproduce the best possible radio music. Tickets for these concerts may be secured by applying to Lieutenant W. B. Schreiber, of Company A, 101st Signal Battalion, Park Avenue and Thirty-fourth Street.

"Little is really known of the great work done by the battalion. Members of the organization, drawn from every walk of life, have been busy for months undergoing a course of instruction that includes, in addition to the popular radio telephony, radio telegraphy, Morse telegraphy and ordinary telephony. The organization is a federalized unit, the members drawing Federal pay for attendance at drill. The powerful station at the armory operates from Fort Wood, on Bedloes Island, headquarters of the 2d Corps Aera, which includes most of Greater New York.

"The training and education afforded the members of the unit provide new fields of endeavor for all. In addition to the technical work necessary and required of each man, the usual routine of military training is also included in the course of instruction. Marksmanship, elementary and advanced electricity, first aid, personal and camp hygiene and the ordinary infantry tactics compose the general program.

"The series of radio concerts is the best evidence of the thoroughness of the training afforded and provided by the organization. The operation of the receiving sets will be conducted by enlisted men of the battalion, many of whow knew little or nothing regarding the manipulation of the various pieces of apparatus at the time of joining the organization.

"Of course, there are numerous other features and advantages, as entertainments, athletics and any variation of club privileges make possible the enjoyment of membership in the organization that compares very favorably with the average social or athletic association.

"The history of the organization is a most interesting one and dates back to the late '70s, when the first signal company was organized in New York. The members have, as a unit and individually, taken part in the Spanish-American War and the recent great World War, establishing reputations that are looked upon with pride by the present organization. The enthusiasm shown around the armory by the members marks well the intense interest the men take in their work and the pride manifested in their being signalmen.

"Application for membership can be made to Lieutenant H. G. Martin, Jr., recruiting officer, 101st Signal Battalion, N. Y. N. G., Park Avenue and Thirty-fourth Street."

Presides By Radio

For the first time in history, two meetings of electrical men were called to order April 26 by radio telephone. Walter Newmuller, Secretary of the New York Edison Company, at the broadcasting station of the Western Electric Company, West Street, New York, talked before members of the New York Electrical League at the Hotel Astor and the New York Electrical Society at the new Hell Gate Station of the United Electric Light and Power Company.

He called the meetings to order at noon and after a short opening address introduced several opera stars, who rendered selections over the radio. Mr. Newmuller then went to the Astor to preside over the meeting of the New York Electrical League, and Thomas E. Murray, Vice President of the New York Edison Company, also rendered several selections over the radiophone. John Miles of the Western Electric Company discussed radio problems at the Astor.

International Conference To Standardize Radio

Paris.—The International radio conference of Americans, British, French and Germans, which is attempting world-wide standardization of wireless traffic, will resume its sessions at London on April 24, when it is hoped final agreements will be reached. The United States is represented by the Radio Corporation of America, England by the British Marconi Company, Germany by the Telefunken Company and France by Radio-France.

Five day sessions in Paris is understood to have been devoted principally to discussion of the use of different wave lengths by various countries to avoid interference and international agreements governing sending and receiving. These experts will meet in Berlin in June to present complete findings.

Although he declined to disclose the results of the conference, Edward J. Nally, president of the Radio Corporation of America, who, with Owen D. Young, vice-president of the General Electric Company, represents American interests, said the delegates were endeavoring to devise a means for the extension and proper control of broadcasting. He added that Germany, France and England were sending experts to the United States to study distribution methods there.

"One of our greatest hopes for the future," said Mr. Nally, "is the establishment of an international radio language or code, like Esperanto, which could be understood by all. This would place the activities of the whole world at everybody's ear. There is no reason why every American schoolhouse should not have a simple wireless apparatus to enable teacher and pupils to listen to what the rest of the world is doing."

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Conference to Draw Schedule

The sudden increase in the number of radio broadcasting stations in and around New York city all operating upon a 360-meter wave, has produced a serious situation, which may develop into troublesome interference. This fact is realized by the operators of the stations in question, and there is a possibility that a conference will be held during the coming week to solve the problem caused by the stations.

In all probability some schedule will be evolved at the conference whereby all of the stations can operate during the day without interfering with each other. At the same time it is expected that the large commercial broadcasting stations which have been in operation for some time will be given a preference in operation.

New Radio Code Issued by Fire Underwriters

The National Board of Fire Underwriters have made public tentative regulations covering radio receiving installations that disclose considerable modification as compared with the requirements previously issued by fire underwriters.

The specifications that follow were drawn up by a special committee of the National Fire Protection Association, which is the authority for the national electrical code and whose findings are standards of engineering practice. Besides the underwriting organizations represented upon this special committee, engineers acting for the American Radio Relay League, American Telephone and Telegraph Company, Radio Corporation of America and and the Independent Telephone Association also participated.

The new rules are being published as proposed amendments to be included in future editions of the electrical code. It is stated that the requirements contained in the current edition of the code were based largely on the hazards incident to the equipment of wireless telegraph transmitting stations where antennae of considerable height and length were used and where the hazard of high potential equipment had to be considered.

The recent widespread installation of radio telephone receiving sets has necessitated a revision of the regulations. The receiving set having an indoor antenna is considered devoid of hazard. With any receiving set, the publication says the principal danger is from lightning brought in ovr the antenna to the equipment or to some part of the building. Where there is no exterior antenna this hazard is removed.

The following specifications are for receiving stations only:

NATIONAL ELECTRICAL CODE

Specifications (for Receiving Stations Only):

Antenna

"a. Antennae outside of buildings shall not cross over or under electric light or power wires of any circuit carrying current of more than six hundred volts, or railway trolley or feeder wires, or shall it be so located that a failure of either antenna or of the above mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

"Antennae shall be constructed and installed in a strong and durable manner and shall be so located as to prevent accidental contact with light and power wires by sagging or swinging.

"Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

"Antennae installed inside of the buildings are not covered by the above specifications.

Lead-In Wires

"b. Lead-in wires shall be of copper, approved copper-clad steel or other approved metal which will not corrode excessively, and in no case shall they be smaller than No. 14 B. & S. gage except that approved copper-clad steel, not less than No. 17 B. & S. gage may be used.

"Lead-in wires on the outside of buildings shall not come nearer than four (4) inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-conductor that will maintain permanent separation. The non-conductor shall be in addition to any insulation on the wire.

"Lead-in wires shall enter building through a non-combustible, non-absorptive insulating bushing.

Protective Device

"c. Each lead-in wire shall be provided with an approved protective device, properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignitable stuff or where exposed to inflammable gases or dust or flyings of combustible materials.

"The protective device shall be an approved lightning arrester, which will operate at a potential of 500 volts or less.

"The use of an antenna grounding switch is desirable, but does not obviate the necessity for the approved protective device, required in this section. The antenna grounding switch, if installed, shall in its closed position form a shunt around the protective device.

Protective Ground Wire

"d. The ground wire may be bare or insulated and shall be of copper or approved copper-clad steel. If of copper the ground wire shall be not smaller than No. 14 B. & S. gage, and if approved copper-clad steel it shall be not smaller than No. 17 B. & S. gage. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded steel frames of buildings or other grounded metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc.

"The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Wires Inside Buildings

"e. Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than two inches to any electric light or power wire unless separated therefrom by some continuous and firmly fixed non-conductor, making a permanent separation. This non-conductor shall be in addition to any regular insulation on the wire. Porcelain tubing or approved flexible tubing may be used for encasing wires to comply with this rule.

Receiving Equipment Ground Wire

"f. The ground conductor may be run inside or outside of building. When receiving equipment ground wire is run in full compliance with rules for protective ground wire, in 'Section D,' it may be used as the ground conductor for the protective device.

"Regulations covering sending stations have also been drawn up and copies may be secured from the National Board of Fire Underwriters."

Recruiting By Radio Brings Results

It will be remembered that the News Letter of February 18th published the fact that Mitchel Field had adopted a novel plan of recruiting by radio telephone and had sent broadcast a message calling for enlistments for the various Air Service organizations at that station. As evidence of the fact that this method is effective, letters have reached Mitchel Field from far and wide in reply to this request for recruits. The latest response came from Buffalo, N. Y., in which an applicant for enlistment stated he had received information by radio telephone that Mitchel Field desired recruits for the Air Service. By this and other means, and the very active recruiting efforts on the part of the recruiting office at Mitchel Field, 28 recruits were secured for the Air Service organizations at that station during the month of March.

Books on Wireless

RADIO FOR EVERYBODY. *By Austin C. Lescarboura.* Scientific American Publishing Company.

This volume has been written specially to meet the situation that has arisen as a result of the broadcasting system of radiophone concerts. It is written in language that the layman can understand, and covers practically every phase of the radiophone, from the apparatus at the broadcasting station down to the various types of receivers that are being used by the general public.

In his introduction Mr. Lescarboura says that in order to get into sympathy with the views of the novice he specially installed a receiver to listen into the concerts, so that he could study the subject from the viewpoint of music reception. "Indeed," he says, "the manuscript for this book was written on the very table where I have my radio receiving set."

The book is profusely illustrated with photographs showing various types of receiving and transmitting equipment used in wireless telephone work. There are also a large number of diagrams showing connections for different circuits.

One chapter is devoted to the tuning and adjustment of receiving sets, and another to "Making big sounds out of little ones, or the gentle art of amplifying."

ACQUIRING THE CODE. *By E. P. Gordon.* Wireless Press, Inc.

Now that broadcasting has become popular many novices listening in have been actuated by a desire to learn the continental telegraph code so that they can decipher the messages which they hear surging through the ether. This little volume goes into the subject thoroughly and shows the beginner just what to do in order to avoid many of the errors usually committed in learning the code.

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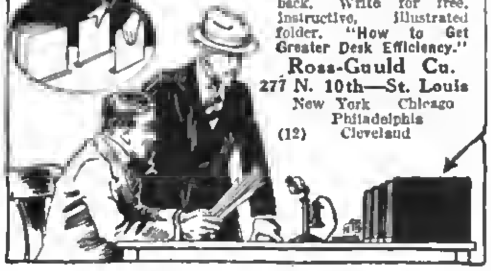

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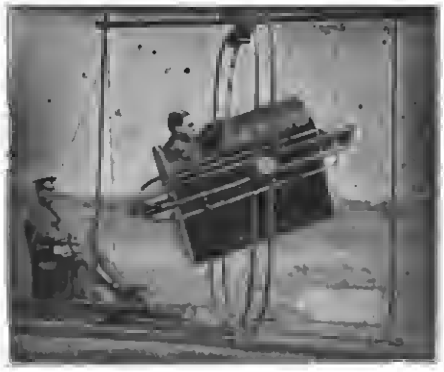

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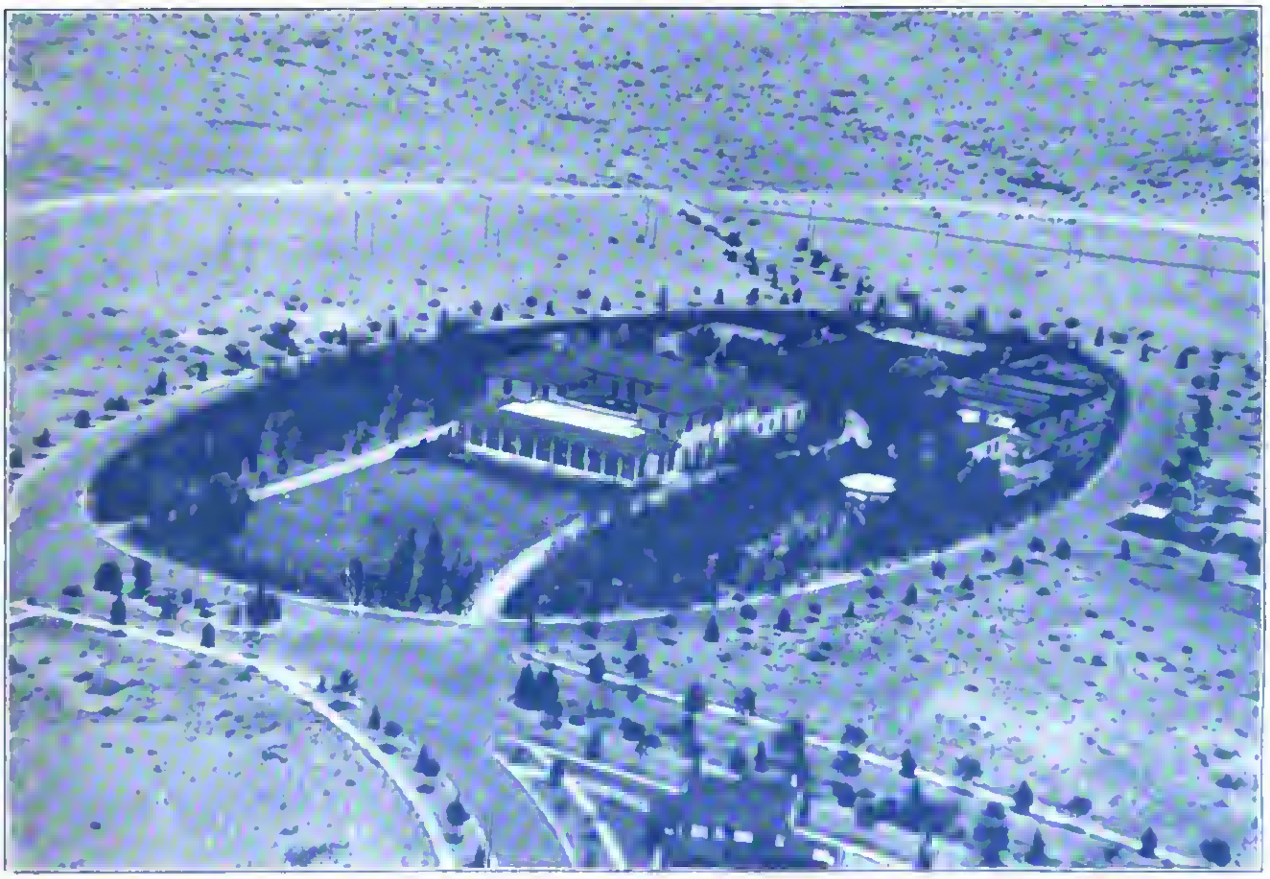

Estate of James G. McNary, El Paso, Texas. Photographed by R. L. Andrews

Aerial Mail Night Flying—Showing an Aviator How he Flies—Advantages of Aerial Mail

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May 22, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 11

TABLE OF CONTENTS

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
5942 Grand Central Terminal, New York City
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Printed in U. S. A.

DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Service!

That is something you must be sure of when you purchase and operate an aeroplane. Curtiss offers a special Curtiss service such as you have a right to expect from the largest and most successful aeronautical organization in America. Curtiss service is prompt, efficient and reliable.

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Tail Assembly, complete	116.40
New Propeller, Mahogany or Walnut (Copper tipped	$40.00
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The above prices are only a few samples; all spare parts priced accordingly. Write for parts price list for JN-4, OX-5, and J-1 Standard before you purchase spares. These reductions have been made in accordance with the Curtiss policy of helpful cooperation with American pilots.

Many flying organizations in all parts of the United States have joined our selling organization and are prepared to sell you Curtiss aeroplanes, motors and parts. Others interested in representing us under our new liberal sales policy may obtain details upon request.

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PUBLISHED WEEKLY BY THE AERIAL AGE CO., 5942 Grand Central Terminal, New York City

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VOL. XV NEW YORK, MAY 22, 1922 No. 11

Aero Club Doing Good Work

THE following official bulletin from the Aero Club of America outlines far-reaching educational work which that organization is now engaged in. There is a certain group of individuals in the United States who are not going to let other countries get ahead of this nation in the "Air". They say that the world powers are today so financially embarrassed that they cannot support huge standing armies and navies and that the next emergency will be marked with a great offensive in the "Air", each side aiming to strike so sudden, so strong and so quickly, that the other will be unable to mobilize its civilian army and navy reserves.

But not only for national defense do they foresee the power of the aeroplane but realizing the all-importance of speedy transportation in any community or state, they foresee the building up of new industries relying on the speed of the aeroplane and demanding this new medium of intercommunication.

Although the aeroplane is a native son of the United States, it appears to be stunted in its growth in its own home locality. There is no directing thought in the country. Here and there one finds sporadic effort on the part of local clubs and societies to develop this power but they are all working at cross purposes. The time is now ripe for an association that all will join and with the united front all "Pull Together" for the furtherance of "Air Power" in the United States. The sponsors of this movement say that this body must be entirely independent and they are giving a great deal of thought and hard work to insuring a democratic, non-partisan, representative association that will not reflect the wishes of any particular community but speak in the behalf of the nation as a whole, so that the necessary legislation, the necessary airways, routes and landing fields, can within as short a time as possible be brought into existence, for they state that with these well established air routes, with the overhead taken care of as it should be, air lines will be a certain success and flying will become every-day and commonplace, safe and regular.

From a standpoint of national pride alone, prompted by no other motive than to keep America first in the "Air" at all times, they are working to bring this about and in this connection Rear-Admiral W. F. Fullam, U. S. Navy, retired, is making a tour of the United States giving lectures, showing the wonderful strides aeronautics has made and organizing the districts and states on behalf of the new association. His route is outlined as follows: Atlanta May 7th, Birmingham May 10th, New Orleans May 12th, Houston May 14th, San Antonio May 17th, Los Angeles May 20th, San Francisco May 24th, Portland, Ore., June 2nd, Seattle June 3rd, Spokane June 5th, Minneapolis June 9th and Chicago June 11th.

Admiral Fullam is attempting to have every city organize an Air Board, this Board to consist of representatives from each society or organization interested in aviation. Chicago has had an Air Board for some time now and it has proved an excellent organization for getting results.

Admiral Fullam attended the Sious City, Iowa, Convention last March and is in an excellent position to direct the other districts in their organization work.

Aerial Mail Night Flying

NIGHT flying, soon to begin on the air mail line across the continent, will render a double service to this country, in the opinion of aeronautical authorities.

Not only will it make it possible for a letter to be shot across the country from San Francisco to New York in twenty-four hours or so but the experience gained in operation will do much to speed the establishment of regular lines of aircraft which will fly day and night.

The competition between aeroplane and railroad train in carrying mail has been somewhat like the celebrated race between the hare and the tortoise, because the tortoise train travels all night while the hare plane stays still on the ground. Even without night flying air mail travels about twice as fast as train mail, but with night flying experts believe train mail will be made to appear like slow freight.

The announcement of night flying was made by Col. Paul Henderson, Second Assistant Postmaster General, in charge of air mail, with the reservation that it would not be attempted until the engineering staff of the service had completed its work of making this type of aviation safe.

When the first plane takes off from Curtiss Field, Garden City, for a night flight, it will not head westward with a depressed pilot, hand glued to stick and eye watching an unsteady compass, wondering where in this or the next world sunrise will find him.

Instead the plane will start with a confident aviator so equipped that it will be a difficult task for him to lose his way unless he loses both sight and hearing.

All the way across the continent this pilot and the pilots relieving him will be guided by beacons shining upward into the air from emergency landing fields thirty or forty miles apart. Thus, at no time during the flight will he be more than twenty miles from a field. In the event that he has to land because of motor trouble, a signal from the plane, a flare, will cause the illumination of the field by flood lights in addition to the beacon.

Each plane, instead of an oscillating compass which can not, because of drifting winds, be used with any certainty, will be equipped with a radio direction finder which will unerringly point the way to the next control field, despite fog, snow, rain or darkness.

These are the plans of the Post Office Department, and already they are well on the way to completion. The lights at the emergency fields, a great number of which already have been located, will be operated by the farmer owning the field.

(Concluded on page 263)

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THE NEWS OF THE WEEK

National Balloon Race

The National Balloon Race will be held this year from Milwaukee, Wisconsin, May 31st, 1922, under the auspices of the Aero Club of Wisconsin. The following prizes are offered: 1st prize, $1,000; 2nd prize, $800; 3rd prize, $600; 4th prize, $300; 5th prize, $200; 6th prize, $100.

Entries have been received from the following: Ralph H. Upson, holder of Spherical Balloon Pilot Certificate No. 48; H. E. Honeywell, Pilot Certificate No. 20; J. S. McKibben, Pilot Certificate No. 135; Roy F. Donaldson, Pilot Certificate No. 47; Warren Rasor, Pilot Certificate No. 50; John Berry, Pilot Certificate No. 24; Bernard Von Hoffman, Pilot Certificate No. 888; also three Army and two Navy balloons.

Santa Maria, With 12 Aboard, Finishes Flight From Cuba

Completing the last leg of a trip that started at Havana, Cuba, the giant flying boat Santa Maria arrived at its station in the North River, New York City, at 2:30 P. M., May 9th.

Aboard the craft were the crew of three and nine passengers. The flight was begun on the previous Wednesday, and was broken by seven landings. A distance of about fifteen hundred miles was covered by the boat, with an elapsed flying time of seventeen hours and thirty-five minutes, as compared with the fifty-seven hours required to make the trip by rail and steamer and the three and a half to four days required by steamer alone.

The Santa Maria was met by a committee representing the Army and Navy Air services, the Aeronautical Chamber of Commerce, aircraft manufacturers and the Aero Club of America. Among those present were Major A. N. Krogstad, representing General Bullard; Commander E. Frederick, representing Captain Vogelgesang, commandant of the 3rd Naval District, and Colonel L. La Tourette Driggs, chief of the New York National Guard Air Service.

The hydroaeroplane returned to the factory at Keyport, N. J., and will come back to the New York City Air Port to he exhibited, when its owner, the Aeromarine Airways, Inc., will inaugurate its summer flying season.

Field at Sheldon, Ill.

The Sheldon Airline, of Sheldon, Ill., announce that they have acquired a landing field eighty rods hy forty rods, clear on all sides, and marked with a "T." It is located on the main line hetween Indianapolis and Chicago, one mile south of Sheldon. Repairs and gasoline are availahle and fliers are welcome.

Commissioner Frazar in New York

Mr. E. W. Frazar, Commissioner, The World's Board of Aeronautical Commissioners Inc. for Japan and Corea, is in New York.

Speaking of Aeronautics in Japan, Mr. Frazer said Japan was far advanced and making wonderful progress on lines of aerial navigation. Mr. Frazar in co-operation with Mr. George Scott, Manager of the Rising Sun Oil Company of Japan (The Shell Oil Co.) has completed the delivery of oils and gasolene for the round-the-world flight from Shanghai via the Aleutian Islands to Alaska and San Francisco.

The stations supplied are Shanghai, Fuson, Tokyo, Kushiro, Etorofu Islam, Petropavlovsk, Kamchatka (Japanese territory), Attu Islands (American territory), Chicago Bay, Alaska points to San Francisco. Landing places in good harbors are about 150 miles apart.

The Tokyo Flying Staff located at Kasunigaura under command of Colonel De Master Semple, with Major Brackley (favorite pilot for the King of Belgium) Chief Instructor, is composed of thirty-six British Naval expert flyers. The entire staff are much interested in the around-the-world flight and will, with the assistance of Major Christie, U. S. Naval Attache, render all possible assistance to the flyers that the Pacific Ocean flight may be a success.

The Japanese fishing fleet between Yokohama and the mouth of the Kamchatka River, 1,945 miles, is composed of ten thousand fishermen. They with the Japanese and American Navy in Asiatic Waters, The Canadian Pacific Steamship Company, will be on the watch for them and render any assistance that may be required.

Mr. Frazer will be at Petropavlovsk near the mouth of the Kamchatka River during July and August and says those two months are best for the flight as the locality is free from fogs and ice.

Aerial Carnival Over Hudson

What was described as a new passenger-carrying seaplane record was established May 14, when the Aeromarine flying cruiser Menrosa, with twenty-seven passengers aboard flew from Keyport, N. J., to the New York airport, at Eighty-second Street and the Hudson. The Mendosa, an enclosed plane, luxuriously furnished, was a feature of a flying-boat carnival that attracted a throng of thousands.

The Mendosa flew from Keyport to the city, an air distance of thirty miles, in twenty-one minutes. The huge craft, painted white and flying an American emblem from one of its stay wires, circled over Riverside Drive and then gracefully alighted on the surface of the river. The cruiser "taxied" into shore, where an opportunity of inspecting it was accorded visitors.

Laurence La Tourette Driggs, founder of the American Flying Club, said the plane, seen here for the first time, was the last word in modern construction and equipment.

"It will not he long before the public will adopt this mode of transportation as a necessity," he said. "Why travel by railroad to Atlantic City, for example, a journeyof hours, when you can fly there just as comfortably in seventy-five minutes?"

The Mendosa has a spacious cahin with seats arranged along the side. It is electrically lighted and glass enclosed, a clear view thus being afforded of the country over which the traveler is passing. In the rear is a separate compartment seating three for those who desire seclusion. A feature is the arrangement of the pilot's seat whereby the passenger may watch the operation of the plane. The Mendosa has a wing spread of 104 feet and is motored with two 400 horsepower Liberty engines.

Contrasting in size with the Mendosa and the Santa Maria, a sister plane, was an Aeromarine sport boat, with a forty-eight foot wing spread, which was used in giving flights to those who preferred an open machine.

In addition to the flight program, a series of manoeuvres intended to demonstrate the various points of seaplane operation was carried out. The carnival was announced as opening the flying boat season in this city.

During the afternoon more than a hundred invited guests flew down the bay. While waiting their turns, they were entertained aboard the steam yacht Wadena. The Reception Committee consisted of Inglis M. Uppercu, C. F. Redden, H. F. Bruno, Earl D. Osborn and F. Rodriguez.

Among those present, most of whom took flights, were Commander Victor D. Herbster, representing the Naval Air Service; Major A. N. Krogstad of the Army Air Service; Lieut. Commander Marzos Zar of the Argentine Naval Commission; Murray Hulbert, President of the Board of Aldermen; Felipe Tahoada, Consul General of Cuba in this city; Mr. and Mrs. Laurence La Tourette Driggs, Miss Diane Gordon, Francis H. Markoe, Dock Commissioner John H. Delaney, and Mr. and Mrs. T. L. Oakley Rhinelander.

Police Air Reserve Is Now Part of Navy

The Aviation Division of the Police Reserves of New York City, including in its membership some of the best flyers in the war, has been mustered into the Navy Reserves. The actual transfer of the "flying cops" into Government service took place this week, and plans were said to be under way to furnish the naval reservists with complete aerial equipment.

Organized three years ago with Rodman Wanamaker, who financed the Wellman expedition, as one of the sponsors, the aerial division has been handicapped by lack of funds. Mr. Wanamaker was understood to have contributed heavily to the outlay as the aviators received no funds from the city. A training school has been maintained at the headquarters of the division in the old Greenwich Street station, where twenty students have been graduated as licensed pilots.

For a time the "flying cops" had the use of four hydroplanes lent by the navy. Five members owned aeroplanes which they placed at the disposal of the division. This completed the aircraft equipment of the force.

It was pointed out that the city still benefited despite the merging of the division with the navy as the aviators still retained their memberships in the Police Reserves, Class VI., into which the flyers have been allocated, renders them available in case of emergency.

Cleveland Aviation and Athletic Club

The inaugural banquet of the Cleveland Aviation and Athletic Club was held at the Hotel Winton on May 13. Addresses were delivered by Capt. Eddie Rickenbacker, Paul Henderson, Second Assistant Postmaster-General, Rear Admiral W. A. Moffat, Chief of the Bureau of Aeronautics, Lt.-Col. H. E. Hartney and Hon. William L. David. The banquet officially opened the club's new quarters.

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The AIRCRAFT TRADE REVIEW

Aeromarine Performance

One of the most important developments in American civilian aviation is the successful operation of the Aeromarine Airways, Inc., of New York, Key West and Havana. Convinced that commercial aviation could be made a safe and financially successful business enterprise if conducted by an efficient organization possessing proper equipment, officials of Aeromarine Airways started their Key West Havana service in the winter of 1920-21. At the close of their second southern season on April 1st, last, Charles F. Redden, president, set to work checking up figures, operating costs and statistics. The books of the company showed that it had made money; but he wanted to know how closely the practical results coincided with the theories on which they have based their operations.

He found that Aeromarine Airways from November 12, 1920, to April 1st, 1922, had flown an aggregate distance of more than 150,000 miles and carried a total of 10,700 passengers—without an accident.

Since last November (1921) Aeromarine Airways made:

184 flights between Key West and Havana; 55 flights between Key West and Miami, Fla.; 91 flights between Miami and Bimini; 53 flights between Miami and Nassau; 16 flights between Miami and Palm Beach; 345 special charter and miscellaneous sightseeing flights.

In last period, the season just closed, 268,535 passenger miles were flown, in a total of 713 hours in the air. Out of the total of 749 flights, all but five were completed; the five being discontinued because of weather conditions, and the planes returned to the starting point. Not a single passenger or employee was injured in these operations. The schedule was maintained throughout, with the exception of the five postponed flights. Three types of flying boats were used: the 11-passenger flying cruisers of the F.5-L type, the Navy Coast Patrol 6-place Hs2L type, and Aeromarine 3-place flying boats.

"Efficiency of the operating personnel, pilots and mechanics and officials at each base, continuous inspection and maintenance of aircraft, adherence to the rule of 'Safety First' observance of weather conditions and knowledge of routes combined to bring about this progressive situation," says Mr. Redden in his report. "We know, now, that aircraft can be operated at a profit, without endangering lives."

International Air Lines in Europe

A meeting of the International Air Traffic Association recently held at The Hague was attended by the following persons: M. Hermant, representing the Compagnie France-Roumane; Mr. Jacobson, representing the Svenska Luft Trafik Aktiebolaget; Mr. Meisterlin, corresponding member of the Association for Norway and representative of Det Danske Luftfart Salskab; M. Pierrot, representing the Compagnie des Messageries Aeriennes; Lieut. Plesman, of the K. L. M.; Mr. Renaud, representing the Societe Nationale pour l'Etude des Transports Aeriens, and Herr Wronsky, representative of the Dantziger Luft Reederei and the Deutsche Luft Reederei.

Lieut. Plesman, manager of the Royal Dutch Air Navigation Company, was elected Chairman.

Discussion of plans for next summer resulted in the following international lines being decided on:

1. London-Amsterdam-Bremen-Hamburg Copenhagen.
2. London-Amsterdam-Bremen-Hamburg Berlin.
3. London-Brussels-Dortmun-Berlin.
4. London-Paris-Lyons-Geneva.
5. London-Paris-Lyons-Marseilles.
6. Amsterdam-Brussels-Geneva.
7. Paris-Strasbourg-Prague-Warsaw-Vienna - Budapest - Bucharest - Constantinople.
8. Konigsberg-Moscow, communicating with the railway services between Berlin and Konigsberg.

It was further decided that the Central Office should issue regulations for aerial services binding upon all the companies which were members. The Central Office was invited to communicate with the Secretariate of the International Postal Union, in order to call that Union's attention to the fact that, although it was impossible to maintain regular services thoughout the whole year, such services were possible from April to September, so that during that time the mail can be regularly carried by aeroplane. The Central Office was also invited to communicate with the Traffic Committee of the League of Nations. Efforts will be made in the direction of simplification of customhouse formalities.

It was further decided that motors should be equipped with an apparatus which served to muffle the sound; that large passenger aeroplanes should carry a pilot and assistant pilot; that machines destined for flights lasting over four hours should be equipped with a lavatory, and that the main parts of the machines should be constructed in such a manner as to be easily exchangeable.

The French Companies, the Belgian and the Slovak Companies have been invited to become members of the Central Office.

The next meeting will be held on July 31st, probably at Brussels.

Petrel Performance

An interesting test which demonstrates the advance in aeronautical engineering made since the armistice, was held in Kansas City, on the American Legion Flying Field, when a Petrel three seater was demonstrated in competition with a one hundred fifty horsepower rebuilt Standard J1.

The Standard is a plane belonging to Mr. John K. Legrone, a veteran pilot of nine years' flying experience. The Petrel used was the demonstrator of the Huff, Daland Aero Corporation which has a main sales base at Kansas City.

The two planes, equally loaded, were taken off the same line at the same time. The Petrel got off the ground in approximately 140 feet or about half the distance required for the Standard. Both planes climbed at their best angles. After the Petrel had reached an altitude of 800 feet it was about 100 feet higher than the other plane and about 400 feet in advance of it. Both planes then levelled off for a speed test, in which it was evident to all spectators on the ground that the Petrel was from twelve to fifteen miles per hour faster in horizontal flight than the Standard, powered with a 150 HP. Hispano.

This test was taken by four or five hundred spectators to be a definite proof of the fact that aeroplane design in 1922 is a very advanced matter over the elements of design in pre-armistice days. It shows that engineers have profited by the vast amount of wind tunnel experimentation made since the war; that American engineers can design planes around foreign aerofoil curves; and that a distinct advance must have been made when a plane of less than thirty feet of wing span can outclimb and outperform a plane of materially greater surface, lighter load per square foot, and much less power.

Asparagus by Air, Jersey to Boston

Fresh asparagus for the midday dinner in the Back Bay district of Boston will be cut the same morning in the Gloucester County, New Jersey, asparagus centre and shipped by aeroplane. Gloucester County is completing details of an air freight daily delivery of 1,000 pounds of the "grass" as they call it in Swedesboro, N. J., so there will be plenty to go around at other Boston dinner tables.

Radio messages to the station of the asparagus kingdom will expedite filling orders. Bert Acosta will have a radio in his Fokker and persons who have transmitters and find they are licking their chops as 1,000 pounds of fresh tender asparagus flies over their heads can call him by radiophone.

Asparagus must be caught young and the Gloucester County Board of Agriculture knows it. Its leading members met recently in Mickleton, at the home of S. Mason Carter, Chairman of the Board's Transportation Committee. Alexis L. Clark, chief of the State Bureau of Markets, attended. It was agreed to send Acosta in his Fokker on a test trip to Boston last week with his 1,000 pounds of "grass" and President White of the Gloucester County board as passenger.

Junior Aeronautical Engineer

The United States Civel Service Commission announces an open competitive examination for junior aeronautical engineer on June 21, 1922. A vacancy under the National Advisory Committee for Aeronautics, at $1,500 a year, will be filled from this examination. Applicants should apply for form 1312, stating the title of examination desired, to the Civil Service Commission, Washington, D. C.

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AERIAL LAWS AND SURVEY OF SAFETY IN FLIGHT URGED BY AERONAUTICAL CHAMBER OF COMMERCE

THE following report covering the calendar year 1921 has been prepared by the Aeronautical Chamber of Commerce for the Department of Commerce.

Three deficiencies operate to the serious embarrassment of American aviation—meager capital, insufficient terminal facilities and popular doubt as to reliability. The correction of these deficiencies, and the consequent opportunity for the rapid growth of aerial transport, depend upon Federal regulation and reasonable control through an Aerial Code.

In a recent issue of Commerce Monthly, organ of the National Bank of Commerce of New York, it was declared: "Wise regulation may be expected to give a certain stability to the air transportation industry essential to any industry which must appeal for credit and for investment capital. Until this is attained air transportation can not be said to be on a business basis. From whatever point of view the subject is approached, the conclusion is inescapable that the enactment of an air law is the first essential step toward the development of commercial aviation in the United States."

The experiences of the inland waterways and the railroads in either burdening themselves with huge terminal debts, or in struggling selfishly for the exclusive control of available sites, a control which meant private monopoly and this, in turn, public burden, point the way for the sound economic treatment of the air port problem. The establishment of common terminals for the encouragement of all aviation, and for the national security in time of need, is a public responsibility, which, if neglected now, will invite difficulties within a few years similar to those in which the waterways and the railways now find themselves.

At the close of 1920, operating reports showed the existence of 128 terminals of all classes, of which five were in Canada, and three others devoted to airship experiment, leaving a net of 120 in the United States. Of this number, probably 20 could be classified as seaplane bases.

At the close of 1921, the operating reports showed a total of 146 air terminals, both land and water, within the United States. All were for heavier-than-air craft. This is an increase of 26 over the preceding year. Of the total number, 30 were classified as seaplane bases. Sixteen of the 146 were publicly owned or controlled.

Deprive the rail and ocean carriers of depots and docks, and operation must cease. Withhold terminals from the American aircraft industry, and aerial transport can achieve neither size nor reliability. The 146 terminals reported available to commercial aircraft in the United States represent the facilities for 600 machines without regard to geographical or business requirements. The wonder is that there has been so much paid fiying from so few fields.

In preparing the data for the Department of Commerce, the worst obstacle encountered in research and analysis was the lack of official machinery with which to obtain thorough and authentic information. Two courses were open—confidential data (as to identification) from the established companies making operating reports; and press stories, covering the general field. It is important to state at this point and to bear continually in mind that the press stories (with the exception of less than half a dozen fatalities) refer wholly to the gypsy flier and thus prove conclusively that the uncontrolled itinerant pilot encounters and causes most of the danger in flying.

One hundred and twenty-five established companies, operating 500 to 600 two and three-place machines, made 130,736 flights, covering 2,907,245 miles and carrying 122,512 passengers in the twelve months, October 1st, 1920-October 1st, 1921. In making their reports, these companies seemed careful to itemize all forced landings, crashes, etc. Yet the number of accidents in which persons were killed or injured, totals but 24.

Six Requisites for Safe Flying

Experience has taught that, in safe flying, there are the following requisites:

1. A machine aerodynamically and structurally sound.
2. An engine of sufficient power and which operates satisfactorily.
3. A competent, conservative pilot and navigator.
4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.
5. Nation-wide weather forecasts specialized and adapted to the need of fliers.
6. Nation-wide chart of air routes.

Analysing the causes to which the 24 accidents are attributed: Of the six fatalities, three were due to stunting, two to gross carelessness on the field, and one to storm. Not a single person, passenger or pilot, lost his life in straight commercial flying. And with Federal regulation, controlling stunting and enforcing proper field policing and protection, it is believed certain most of these fatalities would have been avoided.

There were 21 persons injured in the 24 accidents. These mishaps were due to causes which could have been removed by Federal regulation or supervision—had landing fields, air routes and weather reports been fully available; had the field help been more disciplined; had the pilots been more alert through consciousness of licensed responsibility and had there been strict inspection of aircraft, engines, accessories and supplies.

These deficiencies, as compared with the requisites for safe flying, will be more carefully discussed later, when the case of the irresponsible itinerant is taken up, for it is he, rather than the established, incorporated company, that demands control.

122,512 Flew; Not One Killed

Yet, even conceding the foregoing, it is found that during twelve months, 500 to 600 commercial aircraft made 130,736 flights, traveling 2,907,245 miles, carrying 122,512 passengers (men, women and children) without a single fatality in flight.

Out of these 122,512 people, only 21 were injured in flying and in ground accidents, combined, or a ratio of:

0 fatality to 130,736 flights, and 2,907,245 miles flown, and
1 injury to 6,701 flights, and 138,440 miles flown.

The Case of the Gypsy Flier

It is estimated that during the calendar year 1921, 1,200 aircraft were engaged in civil flying in the United States and that these flew 6,500,000 miles and carried 250,000 persons. These figures are approximate and include both the itinerant and fixed base flying. Many press reports may be inaccurate as to causes, but they afford the only available index into the comparative safety of the total aerial activity.

A survey shows that 114 accidents occurred, not including those that involved Government-owned aircraft. Two of the 114 occurred in January, 1 in February, 2 in March, 6 in April, 16 in May, 13 in June, 13 in July, 28 in August, 16 in September, 8 in October, 8 in November, and 1 in December, progressing and diminishing as the flying season advanced and waned. The accidents were reported from all parts of the United States—30 being in the East, 43 in the Middle West (which has most of the machines and, generally speaking, the best natural landing fields) and 41 in the Far West.

What Caused the Accidents

The 114 accidents resulted in death to 49 persons and injury, more or less serious, to 89. In 48 instances there were no casualties. The 49 lives were lost in 33 accidents and injury to the 89 persons was caused in but 42 accidents.

Each of the 114 accidents recorded was caused by deficiency in one or more of the six necessary requisites for safe flying. Forty-nine were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of Governmental needs we place the Federal examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The knack of flying cannot be retained perpetually without practice, nor can it be maintained at a high degree of competency without regular examination on a common standard for all flying throughout the United States. The same is true of aerial navigators. Both pilot and navigator (many times they are identical) are of equal importance in safeguarding the lives of travelers by air.

Inadequate Landing Fields

Twenty accidents are attributed in whole or in part to inadequate landing fields or to the total lack of terminal facilities. Here is a duty directly imposed upon the Federal Government. During the war the Army and Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1,200 craft in operation.

Lack of Weather Reports

While only 4 accidents are attributed to the lack of weather reports and 10 to the lack of clearly defined routes or limitations in traveling between or over cities, it is certain that aerial transport can not develop until these factors are met. As an illustration—two of the worst accidents in our flying history are attributed to these causes. As one was Naval and the other Military, they can not be included in the

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civic survey, though in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

On March 2nd, a Naval seaplane, according to press reports, sideslipped on to a beach near Pensacola, Fla., and killed five bathers. Either the seaplane had no business over that beach or the bathers had no business on it. In either event, the fatalities would have been prevented had proper authority existed.

On May 28th a large Army plane crashed at Morgantown, Md., killing its seven occupants, who included some of the best-known figures in Military and civil aviation. According to the report of the Inspector General's investigators, the disaster was not due to defects in the machine or to incompetence on the part of the pilot, but to the terrific storm into which the ship flew and of which the pilot had not been warned. The investigators above referred to recommended that "steps should be taken to install a system for interchange of weather conditions and weather forecasts, between flying fields maintained by the various services, including Army, Navy, Mail Service and Coast Guard Service." It was further stated: "Obtaining information of weather conditions on a cross-country flight ranks in importance with the inspection of the engine and plane, and it is highly desirable that, in peace times, except in emergencies, no cross-country flights should be undertaken until available information of conditions on the way has been obtained."

Commercial cross-country or inter-city flights, it is evident, can not be encouraged with safety until there is full protection afforded by establishing civil weather reports and co-ordinating these with the various Government reports. This service, obviously, can not be provided by the several States.

Inspection an Imperative Need

Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the 114 accidents, 22 may be attributed to faults which proper inspection probably would have revealed—4 concerning the plane, 9 the engine and 9 an accessory, gas or oil. This inspection must be made at frequent intervals by Federal authority.

When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that *anyone* can take *any* sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons on the ground. If the standard of control were left to the various States, the hope of correcting this unfortunate condition would seem remote.

In one accident attributed to the attempt of the pilot to stunt an unsafe machine, two lives were lost. An investigator reported that the plane was not a factory-maintained product. He said: "It was one of the Army training types which had passed through many owners and which, my investigation shows, had been in at least four crashes previous to the final one. I found that the machine had been repaired by amateurs, that several of the spars and longerons were patched, some of them in four places. It was the giving way of these spars that undoubtedly caused the wings to collapse. The plane had lain out of doors in the open field all winter and one windstorm had blown it the full length of the field—about 1000 yards—and turned it over end. This spring it had been hauled back to its original position and put together again as best as might be. It was never inspected by a competent person, so far as I was able to learn. I found that the owner of the flying field—who is also a flier—had himself refused to fly this machine when the young man who took it up on its fatal trip was induced to become the pilot."

In the lack of any Governmental examination and inspection, the legitimate manufacturers and operators have endeavored to do what they could. They check up on their products, but their control is of necessity limited to localities and to a comparatively brief period of time. As flying increases, this method must become more hopeless and a stern responsibility is thus placed upon the Federal Government to provide an adequate system of examination and inspection.

Stunting Causes More Than 40% of Deaths and Injuries

Twenty-nine of the 114 accidents occurred during stunting. In these 29 accidents, 20 persons were killed and 36 injured—more than 40 per cent of the total. In other words, stunt flying in unrestricted areas was responsible for almost as many casualties as all other elements combined. Now stunt flying is necessary to testing and essential to warfare. It is believed advisable that all pilots know *how* to stunt so that, in case of an emergency, when *only* a stunt will save their craft, they will be able to act quickly, with understanding and without fear. But the habit of stunting for thrill is dangerous, fatal in many instances, and always harmful to civil flying. A Government system of control, limiting stunting to certain areas, will meet this unfortunate menace to aeronautics. In this connection, however, there is hope of general improvement. State Fairs and other amusements, since the war, have encouraged dare-devil flying as "concessions." But after stunts had killed many people and injured more under spectacular circumstances (such as collisions with grandstands, crashes on beaches, etc.) the New York State Fair Commission, according to press reports, eliminated the dare devil aerial acrobat from its list of attractions.

Collision in the Air

The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The 2 collisions reported occurred during stunt performances. In the first, one man was killed, and in the second, 2 were killed and one hurt.

Crowds Surge On to Field

Eight accidents causing injury to 7 persons are reported through carelessness on the field. In several notable instances the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off or landing, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators get in the way. Only Federal rules rigidly enforced are able to meet this condition.

Searching for the "Unknown" Cause

Finally, 8 accidents which caused death to 4 and injury to one, are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident that Federal authority is required to obtain information in such cases.

Flying Not Unsafe

From the foregoing it is seen that flying, even with the burden of unnecessary hazard imposed through the lack of an Aerial Code, is not unsafe.

Eliminating those deaths caused by stunt flying (20) and those attributed to lack of fields, weather reports and clearly defined air lines or routes (6) which only Federal authority can correct—23 fatalities remain—or one to about every 12,000 passengers, and one to 282,608 miles of travel,—unlicensed, unregulated and uncontrolled, and carried on for the most part in former war machines built from three to four years ago.

In case of the 125 operating companies, which flew 2,907,245 miles and carried 122,512 passengers on 130,736 flights, not a single fatality occurred in straight commercial activity. And it is from this record rather than from the itinerant picture that the public should judge the safety of travel by air. These companies approximate the condition in equipment and personnel which will be general when the Federal Government recognizes its duty and responsibility.

Furthermore, the aeroplane of 1921, powerful and beautiful as it appeared to us, and as it undoubtedly was in contrast with the gliders of Lilienthal and Chanute and even the Kitty Hawk biplane of the Wrights, will some day be to the ultimate flying machine what the primitive train of 1830 is to the Twentieth Century Limited. The designing and engineering features are progressing. Improvements in safety and efficiency are being constantly introduced. These, if aided by regulation and stimulation by the Government, assure security in the air travel of the near future comparable with that of the accepted means of transportation which we have today on rail, road and water.

Performance of B. M. W. 185-Horsepower Engine

This report by S. W. Sparrow deals with the results of a test made upon a B.M.W. engine in the altitude chamber of the Bureau of Standards, where controlled conditions of temperature and pressure can be made to simulate those of the desired attitude.

A remarkably low value of fuel consumption—0.41 pound per b.h.p. hour—is obtained at 1,200 r.p.m. at an air density of 0.064 pounds per cubic foot and a brake thermal efficiency of 33 per cent. and an indicated efficiency of 37 per cent. at the above speed and density. In spite of the fact that the carburetor adjustment does not permit the air-fuel ratio of maximum economy to be obtained at air densities lower than 0.064, the economy is superior to most engines tested thus far, even at a density (0.03) coresponding to an altitude of 25,000 feet.

The brake mean effective pressure even at full throttle is rather low. Since the weight of much of the engine is governed more by its piston displacement than by the power developed, a decreased mean effective pressure usually necessitates increased weight per horsepower. The altitude performance of this engine is, in general, excellent, and its low fuel consumption is the outstanding feature of merit.

A copy of Report No. 135 may be obtained upon request from the National Advisory Committee for Aeronautics.

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RESEARCH PROBLEMS UNDER INVESTIGATION FOR THE SUB-COMMITTEE ON AERODYNAMICS OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

THE following memoranda prepared by the National Advisory Committee for Aeronautics outline the comprehensive character of research work now being done in the United States.

Langley Memorial Aeronautical Laboratory

Controllability Testing

This research is intended to provide definite data as to the response of an aeroplane to its control and to lead to the establishment of definite quantitative standards for controllability.

Tail Pressure Distribution

The distribution of pressure on the tail during steady motion, while interesting from an aerodynamic standpoint, tells but little about the loads and stresses arising, since these always reach their maximum value during accelerations. It is therefore desired to extend the work to the securing of a continuous record of the variation of pressure at a large number of points while maneuvering.

Wind Tunnel Tests on Wings

The necessity of this work is obvious, both to develop new sections of improved properties and to compare sections already tested under different conditions.

Similitude Testing (Wind Tunnel)

Tests are being undertaken in order to provide further data on the scale effect for wings of more modern type than the RAF-6, and also in order to determine the largest size of model that can be used in the Langley Field wind tunnel without interference.

Aileron and Rudder Tests

This work has been undertaken to find the relative efficiency of different locations for the aileron and rudder, and the relative effect of ailerons on different forms of wing.

Experiments with New Balances

The present type of N. P. L. balance, has certain serious disadvantages for high-speed work. Although comparatively satisfactory for low speeds, very large sizes in high speeds impose too great a load on the pivot and require too large a spindle to support the model. Experiments leading to the development of a new and improved type of balance should therefore be undertaken.

Tests for Slip-Stream Effect

The effect of slip-stream on the control surface and on the drag must be determined if wind tunnel testing is to be increased in usefulness. This is particularly necessary in connection with the loads on control surfaces.

Pressure Distribution for Thick Aerofoil Sections

The purpose of this research is to determine the variation of loading along the wing span for such wing sections and plan forms as are likely to be used in all-metal internally-braced designs. This research will supply data very much needed in design work.

Comparison of Wing Characteristics in Models and Free Flight

This research has been undertaken to furnish accurate and complete data on which to base performance estimates.

Determination of a Coefficient of Longitudinal Stability

In the course of free-flight research on stability, an attempt is to be made to determine the comparative values of various "coefficients" of longitudinal stability. It would be a great convenience to the designer to know that by a few simple tests there might be obtained a "coefficient" which actually expressed or indicated, longitudinal stability.

Preliminary Tests of Aerofoils in Free Air

The purpose of this investigation is to obtain large values of Reynolds number on tests of wings. This method not only gives the proper Reynolds number, but it also gives a velocity, a size, a degree of turbulence and an unrestricted body of air which is identical with that in which the full-sized aeroplanes fly. From a preliminary test it was estimated that the lift coefficient of any model can be determined to 2 per cent. and the drag to at least 5 per cent.

Small Oscillations in Steady Flight

This investigation has been undertaken to determine the magnitude of the angular oscillations about the three axes of the aeroplane when in steady flight, and also to determine the angular accelerations by differentiating the curves of the oscillations.

Pressure Distribution Over the Rudder and Fin

The purpose of this research is to determine the distribution of load over the rudder and fin both while the aeroplane is in steady flight and when it is being stunted.

Longitudinal Dynamic Stability

This work is a continuation of that already undertaken on static longitudinal stability. The characteristics of a number of different aeroplanes should be determined with a view to checking up the mathematical theory of their oscillations.

Pressure Distribution on Ailerons

Information on the pressures on the ailerons and on the wing surface surrounding them is desired by designers in computing the stress on the rear spar and also the stress on the aileron itself.

Pressure Distribution Over the Wings of an Aeroplane in Accelerated Flight

At the present time we have no data at all as to flow of air or the distribution of load over an aeroplane wing during accelerated flight, and it is quite probable that under such conditions the loading will be quite different from that in uniform flight. For this reason it is considered that careful study of the loading on the wings under conditions of stunting will be of the greatest value to aeroplane designers.

The Complete Study of an Aeroplane Oscillation

The purpose of this investigation is to aid in extending the theory of aeroplane stability.

The Effect of Longitudinal Moment of Inertia on Aeroplane Oscillations

It seems evident from theoretical work that the dynamic stability of an aeroplane will be greatly influenced by the ratio of the mass of the aeroplane to its longitudinal moment of inertia. The purpose of this investigation will be to determine the magnitude of this effect.

Standardization of Wind Tunnels

This investigation is to include the construction and test of a series of standard cylinders, wing sections, and airship forms, for comparison of the results obtained in different wind tunnels. The models are to be made in four different sizes.

Distribution of Loading Between Wings of Biplanes and Triplanes

This research is to be carried out at gap-chord ratios of 0.8, 0.9, 1.0, 1.1, and 1.2, and with various degrees of stagger for each aerofoil of a series, such as Albatross, RAF-15, USA-27, and USA TS-5 or Göttingen No. 255.

Free Air Tests of Spheres

As it seems fairly certain that the critical values in the resistance of a sphere are a measure of the turbulence in the air, measurements of the resistance of spheres in the free atmosphere are to be made to determine the degree of turbulence, and also to carry the Reynolds number higher than has been done before.

Bureau of Standards (Wind Tunnel)

The Direct Measurement of the Velocity of the Wind Stream in a Wind Tunnel, Independent of Pitot Tube Measurements

Wind speed measurements in wind tunnels at the present time are based entirely upon Pitot tube determinations of wind speed, which in turn are based (1) upon the theoretical head developed in a Pitot tube, or (2) upon calibration of the Pitot tube on a whirling arm which involves corrections for swirl. Other independent measurements of wind speed are desirable.

The Measurement of the Steadiness of the Wind Stream and the Effect of Unsteadiness on the Air Resistance of Models

The purpose of this investigation is to develop methods for measuring quantitatively the unsteadiness in the flow of wind streams, including (1) unsteadiness in distribution, and (2) unsteadiness in time.

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The Effect of Turbulence of the Wind Stream on the Resistance of Bodies of Various Shapes and Its Bearing on Scale Corrections

This investigation is undertaken to determine the effect of turbulence in wind streams on the resistance of models.

Bureau of Standards (Aeronautical Instruments Section)

The Investigation of the Elastic Properties of Springs for Aneroid Instruments

The purpose of this investigation is to determine the performance characteristics of the Bourbon tubes used in aircraft instruments.

The Investigation of the Elastic Properties and Hysteresis of Diaphragms

The purpose of this investigation is to determine the characteristics of various types of diaphragms used in aircraft instruments for measuring pressures with a view to facilitating the rational selection and design of diaphragm elements for any specified purpose. The investigation is to include flat and corrugated metal diaphragms, slack diaphragms, and sylphon diaphragms.

The Investigation of the Behavior of Air-Speed Instruments in an Air Stream Under Reduced Pressures

The purpose of this investigation is to determine the performance of air-speed instruments under reduced pressures and at low speeds in order to make possible the more accurate determination of the air speed of aircraft.

Leland Stamford

Air Propeller Research

In this investigation a large number of models previously used in the tests reported on in Reports Nos. 14, 30, and 64, of the National Advisory Committee for Aeronautics are to be examined by means of the aerofoil theory of the propeller, and the results compared with the results of wind tunnel tests on these sections.

SHOWING AN AVIATOR HOW HE FLIES

AFTER nearly twenty years of flying without knowing just how he did it, man has now conceived a means of recording what an aeroplane pilot does and how the aeroplane responds. Aeroplane designers, builders, owners, instructors and pilots are delighted, though surprised, over the revelations of a method of recording accurately what an aviator does in executing any maneuver in an aeroplane, and also for securing exact data on the performance of an aeroplane in flight. This method has just been devised by the aeronautical experts and pilots of the National Advisory Committee for Aeronautics.

Three special instruments have been perfected to record the speed of the aeroplane in the air, the loadings or changes in weight on the wings, and the movement of the controls by the pilot.

Although fairly complicated themselves, the operation of these instruments is simple and mechanical, the recording being done by means of a photographic film. The results reveal for the first time a practical method of securing information in testing new types of aeroplanes, and for determining the ability and technique of a pilot. The last function of the instruments will be of great value to the pilots themselves and to instructors of novices, who are seldom able to recall just what they did with the controls at a certain point of a flight.

Three Instruments Record All Moves

The first instrument is an air speed meter, a device for recording the speed of the aeroplane through the air. A second is used for recording variations in the loading on the wings in flight, and the landing carriage when landing, taking off, or while running along the ground. In flying through a loop, for example, the pilot is sitting down hard as he goes up and again as he flattens out, but he is literally hanging in his belt at the top of the loop. It is these variations in load on the wings, due to the weight of the aeroplane and the aviator in the air that are recorded by this instrument and the weight on the carriage while on the ground. The third device, the control-position recorder, indicates the exact position of all the controls during any maneuver, or part of a flight. When the pilot gives his ship left rudder it is recorded in degrees, when he dives by pushing on his "stick," or pulls it back to lift the nose, these movements are shown on the record of the flight. After he lands, there is no argument as to what he did, for it is plotted from an automatic record. If one pilot reported that a certain aeroplane was not controlable, he could be checked up by having another pilot put the aeroplane through the same maneuvers, and then comparing the records of both pilots as delineated by this new instrument.

Instruments Act In Unison

These three instruments are synchronized to operate simultaneously, by means of a timing device which makes possible the coordination of the three records into a composite one available for study and analysis. The instruments themselves are not bulky and they do not interfere with the movements of the pilot or operation of the aeroplane. All the attention they require is the throwing of a switch, before a maneuver is begun and when it is completed, to see them all in operation and to stop them.

When the flight is completed the photographic records with their delineations of the pilot's movements and the aeroplane's performance are taken to a laboratory, greatly enlarged for study, and then plotted on a single sheet so that a complete story of the particular flight or maneuver is ready for analysis.

The instruments developed have been employed at the Committee's free-flight laboratory at Hampton, Va., by Test Pilot Thomas Carroll, in studying ordinary and stunting maneuvers, including looping, rolling, the so-called Immelman turn and reverse turn. An extensive study of landing and taking off also has been made.

In his report on the tests, Pilot Carroll points out the importance of taking off and landing, which are the determining factors of the efficiency, and perhaps longevity, of a pilot. Of the two, he says, landing is perhaps the most important, for it is in this phase that the majority of accidents and damages occur. A paper on taking-off and landing by Major R. M. Hill, a British flying officer, is the only one known to have been published on these important maneuvers, and it was this treatise which inspired the tests and developments undertaken by the National Advisory Committee for Aeronautics in this country.

Keeping Tabs on the Pilot

Application of this research work are seen in designing new aeroplanes based upon performance tests, testing advanced and hitherto untried types, and for study by instructors and pilots themselves. The author states: "It reveals to even the skilled pilot startling facts as to his technique." "It is surprising to the flier," he says, "to see an accurate record of his every movement of the controls in the air and the fluctuation of the loading and air speed which have given him but fleeting impressions while he was in the air." Up to the time of these developments in recording instruments, designers and engineers had to depend upon the memories of the test pilots as to the performance of a particular aeroplane. The pilots' recollections were often vague and they frequently disagreed as to the same aeroplane, due perhaps to the personal equation. Today, however, a review of the finished chart by the flier enables him to recall his actions, the response of the aeroplane, and give a comprehensive report, which frequently adds much to the delineations on the chart.

Hitting a Four and One-Half Ton Blow

In one of his recent tests, Pilot Carroll made an especially bad, or "pancake" landing, by levelling-off about six feet above the field, instead of a foot or so as is usually done, to see what effect on the aeroplane a loss of flying speed at that height would have. The record of the blow in vertical acceleration showed that he hit the ground with a force of 4½ times the weight of the aeroplane, or a total force of about four-and-a-half tons. Strangely enough there were no dire results, except that one of the rubber shock absorbers broke. In careful and regular landings this force seldom exceeds 1½ to 2 times the weight of the aeroplane.

Further developments in perfecting these recording instruments include the addition of a recording device to show the progressive speed or revolutions of the engine, and another device to record the actual force or power the pilot applies to his controls, that is, how many foot pounds he exerts in pulling his stick back or pushing it forward in a particular movement. This, it is said, will indicate whether or not the pilot "drives" with a loose or tight rein, and whether he abuses his controls and the aeroplane itself.

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ADVANTAGES OF AERIAL MAIL

Extracts from Address by C. G. Peterson, of the Wright Aeronautical Corporation, Paterson, New Jersey, at a Luncheon of the Engineer's Club and the Flying Club of Baltimore

AS I see the situation, the most helpful sign of the present time for commercial aviation is the attitude of Congress in realizing the necessity of having private contractors carry mail by air. There have been two bills presented on this subject, one by the Honorable Halvor Steenerson, Chairman of the Committee on Post Offices and Post Roads, and one by Honorable M. Clyde Kelly, of Pennsylvania, a member of that committee. Let me quote from a prepared statement given by Mr. Kelly in May: "It has never been the policy of Congress or the Post Office Department to monopolize the carrying of mail matter by aircraft. It is believed that more rapid advancement can be made and more economical service given if private concerns are encouraged to perform this task of transportation." In looking at what can be accomplished by aerial transportation of mail, let us take a concrete example of a proposed air mail route between two cities—New York and Chicago. I will give you some actual figures on the quantity of mail now moving between those cities, the time which can be saved, and the costs of transporting this mail by aeroplane.

There are approximately 25 tons of firstclass mail daily from New York to Chicago. This includes the gateway mail at each end and considerable other mail matter, in addition to letters. There are on an average of 160,000 letters a day collected in New York City for delivery in Chicago City. This quantity does not include gateway mail at either end. The quantity of gateway mail is several times this amount. There are approximately 325,000 letters a day sent from Chicago to New York for delivery in New York City. The figures given are for letters and firstclass mail, and do not include other classes of mail of which there is a tremendous volume.

I will show you in detail from charts prepared from the present actual train schedules the time and quantity flow of this mail between New York and Chicago. These charts also include the lay-over time between the arrival of the train and the delivery. On these charts we have shown a mail plane "flight" paralleling each of the principal mail trains. It must be noted in this connection that the time of arrival and departure of most of these trains has not been set for the convenience of the Post Office Department, whereas if mail planes are operated their time of departure can be scheduled to meet the postal requirements.

WESTBOUND

Train No. 43, the newspaper train, with three 60 foot R. P. O. cars and 5 storage cars, leaves New York at 2:10 A. M., arrives in Chicago 24 hours afterward, and its mail is delivered in Chicago at 9 A. M. of the second day, over 31 hours after it leaves New York.

Flight No. 1 will leave New York at 2 A. M., arriving in Chicago at noon for delivery downtown by 2 P. M., saving one business day on 42,000 letters.

Train No. 19 with one 60 foot R. P. O. car and one storage car leaves New York at 5:31 P. M., arriving in Chicago the next afternoon at 4 P. M., too late for delivery that afternoon, and the mail is delivered in Chicago 9 o'clock the following morning 40½ hours after it leaves New York.

Flight No. 3 will take the mail from train No. 19 at Erie, flying it to Chicago, to arrive at noon for distribution by 2 o'clock that afternoon, saving one business day on 42,000 letters.

Train No. 35, is a very heavy letter train, leaving New York at 8:40 P. M., with one 60 feet R. P. O. car and 5½ storage cars, arriving in Chicago at 8 o'clock the next morning. Its mail lays over until the next morning and is delivered 35 hours after leaving New York.

Flight No. 5 will leave New York at 8 P. M., arriving in Chicago at 6 A. M., for the first delivery in the morning, advancing 42,000 letters one business day.

Flight No. 7 is an additional plane leaving New York at the same time but carrying mail for West of Chicago. Flight No. 7 arrives in Chicago at 6 A. M. By using additional planes out of Chicago connecting with Flight No. 7, the mail can be flown to arrive in St. Louis at 10 A. M., to be delivered by noon—to arrive in St. Paul at 11 A. M., to be delivered by 2 P. M.—and to arrive as far West as Kansas City by noon, to be delivered by 2 P. M., saving one business day on 42,000 letters.

Train No. 93 leaves New York at 9:26 A. M., carrying one 60 foot R. P. O. car as far as Cleveland where it arrives at 4:35 the next morning for delivery approximately 24 hours after it leaves for New York.

Flight No. 9 leaves New York at 6 A. M., arriving in Cleveland at noon for delivery by 2 P. M., saving one business day on 42,000 letters.

EASTBOUND

Train No. 32 with one R. P. O. car and four storage cars leaves Chicago at 1:50 A. M., arriving in New York 26 hours later, and its mail is delivered at 9 A. M. of the second day, over 30 hours after it leaves Chicago.

Flight No. 2 will fly from Chicago at 3 A. M., arriving in New York at noon with 42,000 letters to be delivered downtown by 2 P. M., saving one business day on 42,000 letters.

Train No. 22 with one R. P. O. car leaves Chicago at 5:30 P. M., arriving in New York at 5:25 P. M., too late for delivery and its mail is delivered 9 A. M. of the second day, over 38 hours after it leaves Chicago.

Flight No. 4 will fly from Erie at 6 A. M., with the New York mail taken from Train No. 22 which passes through Erie at 5:15, and Flight No. 2 will arrive at New York at 10 A. M. to be delivered downtown by noon, saving one business day on 42,000 letters.

Flight No. 6 will fly from Chicago at 12 o'clock midnight with the mail for Buffalo, Rochester, Syracuse, which has missed train No. 22 at 5:30 P. M. Flight No. 6 will arrive at Erie at 4:30 A. M., transferring its mail to train No. 22 which arrives in Syracuse at 10:45 A. M. for delivery at noon, saving one business day on 42,000 letters.

Train No. 28 with three R. P. O. cars carrying the heavy letter mail leaves Chicago at 11:15 P. M., arriving in New York at 7:15 A. M. of the second day, distributing its mail over 32 hours after it leaves Chicago

Flight No. 8 flies from Chicago at 11 P. M., arriving in New York at 8 A. M. the next morning for distribution 10 hours after leaving Chicago, saving one business day on 42,000 letters.

Flight N. 10 is to forward mail flown from cities west of Chicago. This mail could be flown by air leaving Kansas City at 6:30 P. M., leaving St. Paul-Minneapolis at 7:00 P. M., leaving St. Louis at 8 P. M., leaving Chicago at 11:00 P. M., arriving in New York at 8 A. M., the next morning with 42,000 letters advanced one business day.

Three routes are being investigated by our corporation for a flight from New York to Chicago. We are making an analysis of the weather conditions, the possibility of selecting good emergency landing fields, and the probability of density of traffic along these three alternative routes.

The first route is along the Southern boundary of New York State through Binghamton, Elmira, Erie and Cleveland, to Chicago. The second route is the present mail route through Bellefonte to Cleveland and Chicago. The third alternative route is somewhat longer but present data indicates that the all year around weather conditions will be considerably better. This route is known as the Southern Pennsylvania route through Reading, Harrisburg, Pittsburgh, Columbus, Dayton, and Indianapolis to Chicago. If this Southern Pennsylvania route is selected as a trunk airway for a New York-Chicago flight, the logical point of connection from Baltimore and Washington would be at Harrisburg, which has been selected as the probable location for a radio control station. It will probably be about an hour's flight from Baltimore and Washington to Harrisburg, so the westbound mail from Baltimore and Washington could be dispatched later than the time of the flights leaving New York. On Eastbound mail, the mail for Baltimore and Washington could be flown from Harrisburg and arrive in Baltimore and Washington before the arrival of the through flights in New York.

These charts and the figures given show the actual time which can be saved by flying the mail, and give an idea of the quantity now being dispatched. The cost is the next important item, and in general since we have compiled these detailed figures we have been surprised at the moderate cost of such a service. We have based these costs on the contractor being able to make a four years contract with the Post Office Department. We have figured on the contractor establishing the aids to navigation required. We have figured on the contractor leasing an emergency landing field at every 18 or 20 miles along the route. At each landing field there will be a powerful Beacon light, an illuminated sign, flood lights for landing, and an illuminated indicator giving the direction and velocity of the wind. At approximately every 150 miles we have figured on the contractor establishing a radio compass station. Each plane will be equipped with a combined radio telephone and telegraph set. An automatic sender on the

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plane will telegraph at short intervals the plane identification number. The two radio compass stations between which the plane is flying will chart the position of the plane from these intermittent signals. If the pilot should get off the course he will send an automatic message to the nearest radio compass station. The compass station will telephone to him the compass course to follow and the distance to get back on the course. By this method the pilot will not need to receive telegraphic messages, as the instructions will be sent to him by telephone. Furthermore, he will not need to use his telephone except when he desires. This leaves his attention undivided for maneuvering his plane except when he desires information. We have figures on divisional points with shops and hangars approximately every 250 miles. At these divisional points the mail will be transferred to a fresh plane, fully serviced, and a fresh pilot.

Inasmuch as a trunk air line from New York to Chicago, equipped for day and night flying, will spell the success or postponement of commercial aviation in this country, we consider it advisable for the radio compass stations and the divisional points to be under the control of the contractor so there may be no division of responsibility. We have figured on the contractor using new modern planes which will carry at least 1,000 pounds of mail, with a cruising speed of 100 miles per hour, and a high speed of 20 or 25 miles faster. We estimate that the cost of operating this service, based on a four years contract, flying four planes Eastbound and four planes Westbound daily will be approximately $1,863,000 per year. The four Eastbound planes will expedite 210,000 letters a day, and the fohr Westbound planes another 210,000 letters a day, or saving a business day on 420,000 letters a day. Flying on 310 business days a year would mean 130,000,000 letters per year, and the cost would be less than 1½ cents per letter. This works out that the total cost per mile flown is about $1.00, which is at the rate of one mill per mile per pound.

Now the figures that I have given above indicate what can be reasonably expected in the future. But it must be remembered that in organizing as long a line as this, it will be inexpedient for either the contractor or the Post Office Department to undertake a contract of such magnitude as four planes each way daily. We have therefore prepared alternative figures on flying one plane each day each way. In making up this estimate we have left in all the costs of all the aids to navigation given in the larger estimate, including emergency landing fields, Beacon lights, and radio compass stations, so that the costs given will cover day and night flying. We estimate that flying one plane each way each day between New York and Chicago will cost approximately $800,000 a year based on a four year contract Based on a 1,000 pound load, the $800,000 yearly cost, plus 5%, gives a rate of 1¼ mills per mile per pound or 4¼ cents per mile per cubic foot of cockpit mail space in a plane. On this basis of one round trip per day approximately 25,000,000 letters would be expedited yearly from New York right through to Chicago, and the cost per letter, $800,000 divided by 25,000,000 letters, would be a little over 3 cents per letter, that is if all the mail is *through* mail. If the flight is arranged so that *way* mail can be carried either between intermediate cities or advancing part of the mail from trains which had already carried it some of the distance, approximately 50,000,000 letters per year could be expedited, and the cost would be only about 1 6/10 cents per letter.

Let me quote again from Congressman Kelly, who says: "While the payment for the transportation by aircraft would practically equal the revenues, that fact should not be conclusive argument against the plan, when it is realized that the rural mail carrier receives two cents for every letter, paper or parcel delivered, more than the entire revenue received by the Post Office Department. It is believed a worthy project to continue the rural mail delivery for the promotion of the common welfare."

Another point to be considered is that both bills introduced by Chairman Steenerson and Congressman Kelly call for an increased rate of postage when the sender desires to make use of the air mail. Both bills, however, would allow the Postmaster General to send other mail in order to make up the full capacity of the plane. The use of this additional postage could be expected to grow rapidly and thus cut down the net cost to the Government. It must also be remembered that in preparing the costs of aerial mail, we have not deducted the present cost of transportation by rail. These detailed figures show that the cost of yearly operation is not excessive for the saving of a business day on millions of letters.

Both of the bills now before Congress give a maximum rate per pound per mile above which the Postmaster General will not be allowed to contract for. Unfortunately, the rates given in both bills are too low. Mr. Kelly says of his bill: "This measure has been approved by the Postmaster General with the provision that the rate should be changed to 2 mills per pound per mile." We are heartily in accord with the desirability of either of these bills being passed with a rate of 2 mills per mile per pound, or its equivalent space rate of 5 cents per mile per cubic foot of mail compartment in the plane. The Post Office Department can be depended upon to make their bargains with contractors at or below these rates to protect the interests of the people.

It is urged in view of the promotion of the common welfare which can be accomplished by saving a business day on business letters from the Eastern seaboard to the middle West, and a corresponding saving on letters to the extreme West, that the Engineer's Club and the Flying Club of Baltimore both officially make known to the Post Office Committee of the House and their representatives in the House and in the Senate, their desire as citizens of Baltimore for the passage of the bill to allow the mail to be flown and at rates of remuneration for the contractor which will allow him to establish a safe, efficient, and dependable service.

Baltimore Flying Meet

THE Aeronautical Chamber of Commerce is co-operating with the Flying Club of Baltimore in arranging a flying meet to be held in Baltimore on May 30th. The program embraces some interesting events calling for participation by commercial machines.

Approximately $1,300 to $1,500 in prizes are being arranged. The meet has the support of the local Baltimore civic organizations and particularly of the National Guard. The following is the tentative program:

1. Efficiency Contest
Conditions

1. Having useful load (including fuel) of more than 750 lbs.
2. Contest decided on formula — $E = S\frac{(w-t)}{g}$

   S—speed over course in m.p.h.
   w—total weight loaded.
   t—tare, weight of machine empty plus oil and water.
   g—fuel consumption in gallons over course.
3. Course, Logan Field, to Filtration Plant, to Bay Shore Park, to Logan Field, one circuit 15.4 miles. Entrants will make 4 circuits. Time to be taken from initial to final crossing of Logan Field. Machines off at 1 minute intervals.
4. Prizes: First, $500. Second, $200. Third, $100.

2. Race for Military Planes
Conditions

1. Handicaps.
   D. H., time over course X 1:00, official time.
   S. E., time over course X .92, official time.
   Fokker D. VII, time over course X .92, official time.
   Vought 180 H.P., time over course, X 1:00, official time.
2. Course—Same as (1)—2 laps. Time, taken from initial crossing of Logan Field. Machine sent off—1 minute interval.

3. Precision Flying National Guard Pilots
Conditions

1. Pilots shall climb to 3,000 ft., throttle motor and spiral down, landing at circle. Pilots will be allowed to "jazz" motors in very short bursts, three times for purpose of clearing motor. Pilots should endeavor to make maximum number of spirals and pull up at a minimum distance from center of circle.
2. Formula for determining winner: $\frac{E-N}{D}$

   N—number of spirals made. D—distance in feet from mark.
3. Pilot will, after landing, wait for judge to mark position of center of circle on ground, and will then taxi in to line, clearing way for landing ships. Judge will immediately measure distance from mark.

4. Sport Plane Efficiency Contest
Conditions

1. Pilots will take off and indulge in any acrobatics such as loops, rolls, spins not under 500 ft., examples of slow flying and slow landings, which the pilot decides will show the value of his ship.
2. Efficiency of performance to be determined by 3 judges.
3. Any pilot stunting under 500 ft. or over crowd will be disqualified for any further participation in meet.
4. Prizes: First, $250. Second, $150. Third, $100.

5. Bombing of Fort Carroll by U. S. Air Service Pilots
Conditions

1. Pilots will bomb a silhouette of Fort Carroll with smoke bombs from altitude of 3,000 feet, using 25 lb. smoke or including bombs.
2. Details to be decided by U. S. Air Service and Aeronautical Chamber of Commerce.

6. Balloon Sniping Contest, National Guard Officers
Conditions

1. Pilot and observer, latter with pump gun loaded with small shot will climb to 2,000 feet, when at this altitude, three balloons of approximately 2 feet diameter will be released at 1 minute interval. The observer who shoots down these balloons in shorter time, wins.

7. General Flying and Demonstration of Commercial Planes

Commercial planes are allowed to carry passengers and give any demonstrations they desire. Commercial planes who desire to carry passengers for pay during meet may do so, except during events Nos. 3 and 5.

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LANDING FIELDS IN THE UNITED STATES

Long Island

Gravesend Bay.—Latitude 40° 34' N., longitude 74° 00' W.
Fair grounds; near Coney Island; mile track; ideal.
New Dorp.—Latitude 40° 34' N., longitude 74° 06' W.
No data.
Plum Island.—Latitude 41° 10' N., longitude 72° 12' W.
Fort Terry Parade Ground; across Long Island Sound.
Sayville.—Latitude 40° 45' N., longitude 73° 05' W.
Emergency field; Sayville radio towers near.
Sotuhampton.—Latitude 40° 54' N., longitude 72° 25' W.
Emergency; near beach, also at West Hampton.
Westbury.—Latitude 40° 45' N., longitude 73° 35' W.
Roosevelt Field; the best on Long Island; 3,000 feet square; four hangars.
Woodbury.—Latitude 40° 50' N., longitude 73° 26' W.
Webb Field; old Government field; ideal.

North Carolina

Bellhaven.—Latitude 35° 32' N., longitude 75° 37' W.
Seaplanes; no data.
Columbia.—Latitude 35° 55' N., longitude 76° 14' W.
Seaplanes; no data.
Danville.—Latitude 36° 01' N., longitude 79° 36' W.
Emergency field, on hilltop.
Edenton.—Latitude 36° 04' N., longitude 76° 35' W.
Seaplanes only; no data.
Elizabeth City.—Latitude 36° 18' N., longitude 76° 13' W.
Seaplanes only; no data.
Hamlet.—Latitude 34° 55' N., longitude 79° 39' W.
Emergency fields in open country around.
Hertford.—Latitude 36° 11' N., longitude 76° 28' W.
Seaplanes only; no data.
Kinston.—Latitude 35° 15' N., longitude 77° 34' W.
Hill Field; 500 by 1,000 feet; south of river; north of railroad.
Monroe.—Latitude 35° 00' N., longitude 80° 32' W.
Reported by the National Aircraft Underwriters' Association; no data.
Newbern.—Latitude 35° 06' N., longitude 77° 02' W.
Field of the Acme Film Co.; 150 by 700 feet; good when wet.
Oriental.—Latitude 35° 02' N., longitude 76° 41' W.
Seaplanes; no data.
Plymouth.—Latitude 35° 52' N., longitude 76° 44' W.
Seaplanes; no data.
Swan Quarter.—Latitude 35° 25' N., longitude 76° 20' W.
Seaplanes only; no data.
Washington.—Latitude 35° 33' N., longitude 77° 03' W.
Seaplanes only; no data.
Wrightsville Beach.—Latitude 34° 12' N., longitude 77° 48' W.
Seaplanes only; no data.

Ohio

Alliance.—Latitude 40° 55' N., longitude 81° 06' W.
Country Club; emergency field.
Canton.—Latitude 40° 48' N., longitude 81° 22' W.
Real Estate Company Field; 800 by 1,500 feet; bordered by streets.
Findlay.—Latitude 41° 03' N., longitude 83° 37' W.
Emergency; near old fair grounds; 1,000 by 3,000 feet; ideal.
Fremont.—Latitude 41° 20' N., longitude 83° 06' W.
Christy Farm Field; 700 by 1,200 feet; ideal.
Hamilton.—Latitude 39° 23' N., longitude 84° 32' W.
Emergency; fair grounds.
Ironton.—Latitude 38° 31' N., longitude 82° 40' W.
Field of the Rafusa Flyers (Inc.); flying instruction.
Kenton.—Latitude 40° 38' N., longitude 83° 36' W.
Emergency; fair grounds; ½-mile track.
London.—Latitude 39° 53' N., longitude 83° 26' W.
Field of the London Aero Club (Inc.), 1,500 feet square; hangar; supplies.
Ravenna.—Latitude 41° 10' N., longitude 81° 15' W.
Willard Brady Field; 750 by 1,200 feet.
Steubenville.—Latitude 40° 22' N., longitude 80° 35' W.
Emergency; country club; 1,800 by 300 feet.
Youngstown.—Latitude 41° 06' N., longitude 80° 37' W.
Olds Farm Field; 1,400 by 1,600 feet; near country club; ideal.
Zanesville.—Latitude 39° 57' N., longitude 82° 00' W.
Emergency; 900 by 650 feet; also ½-mile track.

Oklahoma

Altus.—Latitude 34° 38' N., longitude 99° 15' W.
80 acres; square; wheat stubble; near edge of town; altitude 1,500 feet.
Alva.—Latitude 36° 50' N., longitude 98° 45' W.
Emergency.
Anadarko.—Latitude 35° 04' N., longitude 99° 15' W.
Fair grounds track; 500 by 1,000 feet; good.
Arapaho.—Latitude 35° 32' N., longitude 99° 01' W.
Black Farm Field; 350 by 1,000 feet; good; altitude 1,500 feet.
El Reno.—Latitude 35° 30' N., longitude 97° 58' W.
Emergency; between city and country club; 48 acres; square; soft when wet.
Medford.—Latitude 36° 50' N., longitude 97° 43' W.
Field of the Grand Amusement Co.; 1,200 feet square; ideal.
Stigler.—Latitude 35° 15' N., longitude 95° 06' W.
Municipal field; 1,200 feet square; fair grounds; good when wet.

Oregon

La Grande.—Latitude 45° 20' N., longitude 118° 07' W.
Municipal; 320 acres near race track; ideal; good when wet.
Marshfield.—Latitude 43° 22' N., longitude 124° 12' W.
Municipal; 1,000 by 500 feet; good when wet; oil tanks north and south.

Pennsylvania

Bethlehem.—Latitude 40° 37' N., longitude 75° 23' W.
Emergency; 1,000 by 1,500 feet; 4 miles south of town.
Dauphin.—Latitude 40° 23' N., longitude 76° 57' W.
Emergency; 50 acres.
Hatboro.—Latitude 40° 10' N., longitude 75° 06' W.
Commercial; 16 miles north of town; along York Road.
Irwin.—Latitude 40° 21' N., longitude 79° 41' W.
Field of the Irwin Aircraft Corporation; 20 miles east of Pittsburgh; hangar.
Mechanicsburg.—Latitude 40° 13' N., longitude 77° 03' W.
Municipal; 30 acres.
Williamsport.—Latitude 41° 17' N., longitude 71° 04' W.
McCormic Motor Car Co.'s Field; 100 acres, along river; hangar.

Rhode Island

Pawtucket.—Latitude 41° 54' N., longitude 71° 22' W.
Emergency; no data.
Quonsett.—Latitude 41° 35' N., longitude 71° 25' W.
Emergency; state property; on bay, unlimited space.
Sandy Point.—Latitude 41° 40' N., longitude 71° 25' W.
Emergency; 5 miles east of Greenwich.

South Carolina

Beaufort.—Latitude 32° 36' N., longitude 80° 40' W.
Seaplanes only; no data.
Ducwest.—Latitude 34° 20' N., longitude 82° 24' W.
Aerial mail station; experimental station.
Georgetown.—Latitude 32° 22' N., longitude 79° 17' W.
Seaplanes only; no data.

South Dakota

Tyndall.—Latitude 43° 00' N., longitude 97° 51' W.
Field of the Tyndall Aeroplane Co.; 1,000 by 1,200 feet; hangar with circle on roof; good when wet.

Tennessee

Clarksdale (Memphis).—Latitude 35° 09' N., longitude 90° 00' W.
Field of the Memphis Aerial Co., near country club; hangars, etc.
Jellico.—Latitude 36° 36' N., longitude 84° 09' W.
Municipal; 60 acres; ideal; hangars, etc.

Texas

Blockners Ranch.—Latitude N., longitude W.
Near Rio Grande River; used by border patrol pilots.
Bracketville.—Latitude 29° 17' N., longitude 100° 18' W.
For Clark Drill Grounds; 4,000 feet square; ideal; good when wet.
Brenham.—Latitude 30° 10' N., longitude 96° 21' W.
Stone Meadow; 40 acres; ideal, good when wet; marker, hangar, etc.
Herne.—Latitude 30° 51' N., longitude 96° 31' W.
Elite Field; 35 acres, triangular; ideal; good when wet; hilly country.
Kernah.—Latitude 29° 32' N., longitude 95° 01' W.
Roberts Field; 1,600 by 1,800 feet; ideal; good when wet; east of creek.
Sabinal.—Latitude 29° 16' N., longitude 92° 26' W.

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Emergency; ideal; good when wet; ¾ mile square.

San Diego.—Latitude 27° 45′ N., longitude 98° 14′ W.

Emergency; no data.

San Ygnacio.—Latitude 27° 00′ N., longitude 99° 19′ W.

Emergency; no data.

Taylor.—Latitude 30° 32′ N., longitude 97° 24′ W.

Tarner Pasture; emergency; 1,600 feet square; ¾ mile southwest of town.

Yoakum.—Latitude 29° 17′ N., longitude 97° 10′ W.

Emergency; on edge of town; 600 by 1,500 feet; along road; ideal.

Utah

Henefer.—Latitude 41° 01′ N., longitude 111° 30′ W.

Northwest of Coalville; emergency field.

Vermont

Brattleboro.—Latitude 42° 51′ N., longitude 72° 07′ W.

Emergency; good; marked with 100-foot circle.

St. Johnsbury.—Latitude 44° 26′ N., longitude 72° 01′ W. Emergency; along river.

Virginia

Cape Charles.—Latitude 37° 07′ N., longitude 75° 58′ W.

Seaplanes only; no data.

Washington

Everett.—Latitude 47° 58′ N., longitude 122° 11′ W.

Emergency; no data.

Kennewick.—Latitude 46° 13′ N., longitude 119° 07′ W.

Kelso Field.—Latitude 46° 09′ N., longitude 122° 55′ E.

Municipal; 160 acres; ideal; hangar, marker, etc.

White Bluffs.—Latitude 46° 45′ N., longitude 119° 28′ W.

Field of the Yakima Aviation Company; on Yakima to Spokane route.

West Virginia

Buffalo.—Latitude 44° 29′ N., longitude 81° 13′ W.

Aero Club Field; aerial taxi lines.

Huntington.—Latitude 38° 26′ N., longitude 82° 27′ W.

Commercial Flying Field.

Wisconsin

Alma.—Latitude 44° 18′ N., longitude 91° 52′ W.

Emergency; good fields on Minnesota side of river.

Buffalo.—Latitude 43° 45′ N., longitude 89° 29′ W.

Good cross country field.

Green Bay.—Latitude 44° 29′ N., longitude 88° 01′ W.

Aero Club Field; 1½ miles west along Fox River; 750 by 2,500 feet; ideal; good when wet; hangar and marker; seaplanes use river ½ mile away.

Minong.—Latitude 46° 07′ N., longitude 91° 48′ W.

Emergency; marked.

Pheasant Branch.—Latitude 43° 06′ N., longitude 89° 36′ W.

Good emergency field along railroad.

Stevens Point.—Latitude 44° 30′ N., longitude 89° 32′ W.

Fair grounds; ½ mile track.

Wyoming

Buffalo.—Latitude 44° 20′ N., longitude 106° 40′ W.

Emergency field; reported by the West Aero Corporation of Casper.

Casper.—Latitude 42° 51′ N., longitude 106° 20′ W.

Field of the Western Aero and Motor Corporation; Curtiss distributors; good when wet; hangar and supplies; altitude 5,400 feet.

Elk Mountain.—Latitude 41° 45′ N., longitude 106° 22′ W.

Emergency field; broad plains.

Greybull.—Latitude 44° 30′ N., longitude 108° 03′ W.

Emergency; no data.

Lander.—Latitude 42° 50′ N., longitude 108° 42′ W.

Emergency; no data.

Riverton.—Latitude 44° 02′ N., longitude 108° 22′ W.

Emergency; no data.

Shoshoni.—Latitude 43° 13′ N., longitude 108° 06′ W.

Emergency; no data.

Thermopolis.—Latitude 43° 40′ N., longitude 108° 13′ W.

Emergency; no data.

Worland.—Latitude 44° 02′ N., longitude 108° 58′ W.

Emergency; no data.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, March, 1922

DIVISION	Gas	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchman	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gas	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	$3,378.04	$676.86	$2,735.29	$2,641.56	$836.67	$1,000.31	$2,983.22	$1,407.47	$4,069.78	$3,363.70	$1,667.55	$754.88	$25,515.33	11,805	414 52	38,500	$61.48	$0.66
CENTRAL Chicago-Rock Springs.	5,149.65	1,057.91	8,944.24	2,238.42	859.45	752.37	3,341.61	2,038.41	6,002.17	7,100.47	2,415.07	1,093.26	40,993.03	18,560	755 52	68,920	54.22	.59
WESTERN Rock Springs-San Francisco	3,307.78	614.30	5,348.38	2,220.17	1,317.57	736.51	3,273.91	1,407.48	4,529.26	4,198.80	1,667.54	754.88	29,376.58	11,167	468 36	43,244	62.70	.68
Totals and Averages.....	$11,835.47	$2,349.07	$17,027.91	$7,100.15	$3,013.69	$2,489.19	$9,598.74	$4,853.36	$14,601.21	$14,662.97	$5,750.16	$2,603.02	$95,884.94	41,532	1,640 20	150,664	$58.35	$0.64

Total Operating Cost..........................	$95,884.94
Permanent Improvements........................	614.04
Grand Total..........................	$96,498.98

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern..........................	$0.19	$0.21	$0.26
Central..........................	.12	.18	.29
Western..........................	.18	.20	.30
Entire Service............	$0.16	$0.19	$0.29

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.
Flying consists of: Gas; Grease and Oil; Pilots.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

PAUL HENDERSON, Second Assistant Postmaster-General.

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FOREIGN NEWS

BRITISH SAFETY FUEL TANK AWARDS

The British Air Ministry announces: The prizes in the Air Ministry Competition for Safety Fuel Tanks for aircraft have been awarded as follows:

First Prize—£1,400. The India-Rubber, Gutta Percha and Telegraph Works Company, Limited, Silvertown, London, E. 16.

Second Prize—£400. Imber Anti-Fire Tanks, Limited, West Road, Tottenham, London, N. 17.

Third Prize—£200. Commander F. L. M. Boothby, (R. N. Retired), "Overway," Tilford, Surrey.

The Competition was arranged in order to promote the evolution of a reliable type of fuel tank for Service and Commercial aircraft, which would reduce the risk of fire, due to crashing or hostile action, to a minimum.

Twenty-six entries were received for the Competition, which was open to the world, and eighteen different types of tanks were actually submitted for test.

The Judges appointed by the Air Council consider that the competition has resulted in the achievement of the objects for which it was instituted and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on Service and Civil aircraft and which, for a slight increase in weight over and above that of the standard Service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines.

All the tanks tested, with a few exceptions, showed marked superiority in almost every respect over the standard Service steel tank now generally in use.

The Judges were: Group Captain E. F. Briggs, (Deputy Director of Research); Major B. C. Carter (Directorate on Research); Major J. H. Ledeboer (Directorate of Research); Mr. G. Cockburn (Accidents Investigation Branch); Major J. P. C. Cooper (Accidents Investigation Branch); Mr. H. Grinsted (Royal Aircraft Establishment).

The regulations governing the competition provided that each entrant had to submit two tanks for preliminary trials and that the three most successful competitors in the first stage should submit four more tanks for final trial.

Description of Winning Tanks

Details of the tanks submitted by the three winning competitors for the preliminary tests are as follows:

Tanks Submitted by Messrs. India-Rubber & Gutta Percha Co., Ltd., Silvertown, London

	No. 1	No. 2
Weight of tank	78.75 lbs.	81.25 lbs.
Capacity of tank	37.7 gals.	38.2 gals.
Weight of gallon capacity	.58 lbs.	.66 lbs.
Shape of tank	Cubical	

Each consisted of a welded sheet steel rectangular tank with no frame or baffles or any sort, but with each side slightly dished inwards, inserted in a detachable rubber case.

These tanks were slung in the fuselage by means of webbing.

Tanks Submitted by Messrs. Imber Anti-fire Tanks, Ltd., Tottenham, London

	No. 1	No. 2
Weight of tank	50 lbs.	51.5 lbs.
Capacity of tank	30 gals.	29.3. gals.
Weight per gallon capacity	1.66 lbs	1.76 lbs
Shape of tank	Elliptical	

The tank consisted of a light gauge tinned steel shell which was separated from the inside by a framework of aluminium tubing and light gauge aluminium baffle plates. After assembly the whole of the tank had been covered with india-rubber of a suitable thickness, and all joints vulcanized.

Tanks Submitted by Commander Boothby, Tilford, Surrey

	No. 1	No. 2
Weight of tank	33.23 lbs.	35.75 lbs.
Capacity of tank	58 lbs.	66 lbs.
Weight per gallon capacity	56.8 gals	53.7 gals.
Shape of tank	Cubical	

The tank consisted of an inner bag of 4-ply rubbered fabric capable of containing the petrol with an outer cover of rubbered fabric which was gas-tight. Non-inflammable gas was introduced into the space between the two shells and maintained under slight pressure. A drain pipe was fitted to the outer casing. The tank was fixed to the fuselage by rubber shock absorber and stringing and encased in 3-ply glued on.

Modifications for Final Tests

The three competitors qualifying for the final tests were required to submit four tanks of a type fundamentally similar to those entered for the preliminary trials, any minor modifications which it was desired to incorporate being previously submitted for the consideration and approval of the Judges Committee. This resulted in the following departures being made with the consent of the judges.

1. Messrs. The India-Rubber Co. incorporated the following modification:

(a) The metal of the fuel container was reduced from 20G to 26G.
(b) The capacity was reduced to within the prescribed limits.
(c) The tanks were internally coated with a lead deposit.
(d) Light gauge baffle plates were introduced.
(e) The method of attachment of the flap to the opening in the rubber cover was slightly modified.
(f) The attachment to the fuselage altered in detail but not principle.

2. Messrs. The Imber Anti-Fire Tanks Ltd., introduced compressed rubber buffers at the front of the tank and in place of metal straps and turnbuckles for fixing the end cradles, used leather thong.

3. Commander Boothby substituted a 3-ply outer casing in lieu of the outer fabric shell and was requested by the Committee to reduce the capacity of the fuel container proper to agree with the terms of the regulators.

Details of these modified tanks are as follows:

Tanks Submitted by Messrs. India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.

	No. 1	No. 2	No. 3	No. 4
Weight of tank	57 lbs.	54.5 lbs.	57 lbs.	54.5 lbs.
Capacity of tank	29 gals.	29 gals.	29 gals.	28.8 gals.
Weight per gal. capacity	1.96 lbs.	1.88 lbs.	1.96 lbs.	1.89 lbs.
Shape of tank	Cubical			

Tanks Submitted by Messrs. Imber Anti-fire Tanks, Ltd.

	No. 1	No. 2	No. 3	No. 4
Weight of tank	52.5 lbs.	51.5 lbs.	50.5 lbs.	51.5 lbs.
Capacity of tank	30 gals.	29.7 gals.	29.7 gals.	29.7 gals.
Weight per gal. capacity	1.75 lbs.	1.73 lbs.	1.70 lbs.	1.75 lbs.
Shape of tank	Elliptical			

Tanks Submitted by Commander Boothby

	No. 1	No. 2	No. 3	No. 4
Weight of tank	36.5 lbs.	35.5 lbs.	33 lbs.	35.5 lbs.
Capacity of tank	31.5 gals.	31.5 gals.	31.5 gals.	31.5 gals.
Weight per gal. capacity	1.16 lbs.	1.13 lbs.	1.05 lbs.	1.13 lbs.
Shape of tank	Cubical			

Method of Testing

The method of testing the tanks in the preliminary trials was as follows:

Each tank was mounted in a wooden structure similar in construction to the fore part of the ordinary tractor small type aircraft. The concrete body formed to represent an engine was mounted in front of the tank. The structure containing tank and engine was released down an "I" section girder runway approximately 100 ft. high, so arranged that the body struck the ground at an angle of approximately 45° to the horizontal. It was originally intended to crash the structure on a concrete bed. It was, however, found necessary to modify the conditions and the bed was covered with a 2' 6" depth of sand. The conditions then briefly were those of the typical aircraft crash, the engine partially burying itself, the tank coming into violent contact with the engine. As, however, the fuselage structure at the moment of impact had attained a velocity—allowing for friction and air resistance—of approximately 50 m. p. h. the conditions were more severe than would prevail in a crash from which a human being could hope to escape with his life. The test was intentionally made thus severe in order definitely to reveal weakness or bad points in design.

In the final trains the following tests were imposed:

Two tanks of each type were submitted to acceleration and crashing tests and the remaining two to firing tests, the acceleration test being arranged to imposed stresses approximately equivalent to four times that due to gravity.

The tanks mounted in the fuselage structure were fixed to a pendulum raised to the requisite height and released by a trip gear.

A tank of each type submitted to this test was given two swings and was then placed on one side for 10 to 15 minutes at the end of which, from outside examination, nothing untoward bad occurred.

The crashing tests were carried out in a similar manner to that adopted for the Preliminary Tests with the exception that flints were substituted for sand on the crashing bed.

The tanks submitted to firing test were mounted to their fuselage structures and subjected to bursts of five rounds of Vickers machine-gun fire, composed as follows:

1 Armor piercing, 1 incendiary, 2 armor piercing, 1 incendiary.

Judging

A system of judging was adopted whereby each judge was enabled to record an independent opinion on a common basis. For the preliminary tests this system was on the following basis:

As regards weight, the basis of 100 marks was taken as representing a tank, which, complete with fittings, conformed to the specified weight of 1.75 lbs. per gallon capacity.

For each variation of a decimal point of this weight capacity ratio, 6 marks were added or deducted from the 100 marks.

In addition, as a means of correction in the case of tanks whose capacity was outside stipulated limits, the following formula was adopted.

Marks X Required Capacity

Actual Capacity.

Tanks received marks for the attributes in the following proportion:

(a) Crash-proof qualities	100 marks max.
(b) Remaining attributes	100 marks max.

(b) was divided up as follows:

Durability under Service conditions in the absence of accidents	25 marks
Indifference to extremes of temperature	25 marks
Adaptability of design to large capacities	10 marks
Simplicity of construction	10 marks
Adaptability of design to various shapes	10 marks
Accessibility of fittings	10 marks
Cost of production	10 marks

In awarding marks for the various attributes stated above, the ordinary mild steel service tank was taken as a standard.

This resulted in the following competitors being placed in the order named at the end of the Preliminary Tests:

1st. Commander F. L. M. Boothby; 2nd Messrs. Imber Anti-Fire Tanks Ltd.; 3rd India-Rubber, Gutta Percha & Telegraph Works Co., Ltd.

In the final tests the marking was made on the following basis:

100 marks maximum for each crash test	200
100 marks maximum for each firing test	200
100 marks maximum for remaining attributes	100
Total	500

The final result was:

1st, India-Rubber & Gutta Percha Co.; 2nd, Imber Anti-Fire Tanks; 3rd. Commander Boothby.

Each of these designs showed marked superiority in almost every respect to the standard service steel tank.

Other Tanks

Description of the unsuccessful tanks are appended below:

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Tanks Submitted by Messrs. Beasley, Simms & Morris, 33, St. John's Road, Langley, Nr. Birmingham

	No. 1	No. 2
Weight of tank	78.5 lbs.	73.5 lbs.
Capacity of tank	35.6 gals.	34.8 gals.
Weight per gallon capacity	2.21 lbs.	2.11 lbs.
Shape of tank	Cylindrical	Cylindrical

These tanks were cylindrical and of all-metal construction. They consisted of a petrol-tight outer case containing an inner case with perforated ends, in two separate halves, suspended from flanges on outer case by means of very stiff compression springs.

The tanks were slung between cross pieces at each end which were connected together by longitudinal tie rods, clips being used to secure the whole to the fuselage.

Tanks Submitted by Mr. Bengtsson, 53, Ilford Hill, Ilford, Essex

	No. 1	No. 2
Weight of tank	80.75 lbs.	83.25 lbs.
Capacity of tank	33.8 gals.	33.5 gals.
Weight per gallon capacity	2.39 lbs.	2.49 lbs.
Shape of tank	Rectangular	

This tank consisted of two parts. The fuel container and an outside shell, the space between being filled with sheet cork.

Tanks Submitted by Mr. Bramson, Feeture, Girondo, France

	No. 1	No. 2
Weight of tank	60 lbs.	62 lbs.
Capacity of tank	38.2 gals.	36.1 gals.
Weight per gallon capacity	1.57 lbs.	1.71 lbs.
Shape of tank	Cubical	

These tanks were provided with but one outlet and one inlet connection and were of a very complicated construction; they had an inner compartment consisting of a duralumin frame covered with petrol-proof-doped silk over which was a layer of rubber "Caoutchouc mousse," which is a material of the sorbo-sponge type, but with very minute cells not in communication with one another; the rubber, therefore, was not porous. To ensure that if pierced the hole would seal up, this rubber was fitted under lateral compression and was held in place by a very fine mesh wire gauze.

This inner receptacle was slung in a metal framework by means of a wire net which was anchored to what eventually would be the four rear corners, another cover of fabric, caoutchouc-mousse, and a final one of fabric completed the tank. The last cover of fabric caoutchouc-fabric was kept a small distance away from the inner container by means of thin strips of wood, the space being utilized for CO_2 under pressure which is communicated to the inner portion of the tank by means of a small hole at the top.

The whole was mounted on four bearers which sat on the fuselage frame and were lashed in place by means of shock absorber elastic so as to allow a possible movement of approximately 4".

Tanks Submitted by Mr. Brooke, 9, Perkside Terrace, Cullingworth, Nr. Bradford

	No. 1	No. 2
Weight of tank	64.5 lbs.	61.25 lbs.
Capacity of tank	37.2 gals.	Due to leak from damage, capacity could not be taken.
Weight per gallon capacity	1.73 lbs.	
Shape of tank	Cubical	

The tanks were constructed with a rectangular inner metal tank built round a tubular framework and placed in the outer case, the surrounding space being packed with sheep's wool. Outside the other case was another layer of sheep's wool and around the whole were wound two layers of fine iron wire. The inner framework was also bound in each direction by iron wire. The tank was held in place by five tension springs on each of four corners.

Tanks Submitted by Mr. Delauny, 4 Rue Piedfort, La Havre, France

	No. 1	No. 2
Weight of tank	107.5 lbs.	Received in badly damaged condition and not tested
Capacity of tank	31.6 gals.	
Weight per gallon capacity	3.4 lbs.	
Shape of tank	Cubical	

The construction was similar to that submitted by Mr. Bengtsson, being a rectangular inner metal tank and outer case, with the intervening space packed with cork—see photograph 4685. This tank had but two connections, an inlet on top and an outlet at the bottom.

Tanks Submitted by Mr. Dickinson, Torquay House, West Cross Lane, Swansea

	No. 1
Weight of tank	92.5 lbs.
Capacity of tank	43.1 gals.
Weight per gallon capacity	2.15 lbs.
Shape of tank	Cubical

This tank consisted of an inner and outer tank, there being an air space of 1¼" between the two. This space was filled with lightly packed absorbent cotton and a chemical solution.

Tanks Submitted by Mr. Gibson, 16, Dyke Perade, Cork

	No. 1	No. 2
Weight of tank	50.8 lbs.	51 lbs.
Capacity of tank	30.9 gals.	30.9 gals.
Weight per gallon capacity	1.65 lbs.	1.65 lbs.
Shape of tank	Barrel-shaped	

These tanks were barrel-shaped and of all-metal construction; they were made of but one casing with two ordinary baffles and two truncated conical baffles, the base of each pointing to the end of the tank nearest to it and the small end joined to the two ordinary baffles.

Tanks Submitted by Captain Goete, Instituto Sperimentale Aeronautico, 5 Lungtevere, Michelangelo, Rome

	No. 1	No. 2
Weight of tank	51 lbs.	57 lbs.
Capacity of tank	30.1 gals.	31.1 gals.
Weight per gallon capacity	1.69 lbs.	1.83 lbs.
Shape of tank	Cylindrical	

They consisted of an inner tank of four separate compartments and an outer tank, the intervening space being filled with CO_2 or exhaust gas under pressure, approximately 3 lbs. per square inch. The four compartments were intercommunicable by means of special non-return valves which, in the event of a crash, were intended to shut off any broken compartment from the others. A small hole joined the outer space with the inner spaces, so enabling the petrol to be put under pressure.

Tanks Submitted by Mr. Hobbs, 268, High Road, Wood Green, London

	No. 1	No. 2
Weight of tank	75.5 lbs.	78.5 lbs.
Capacity of tank	40.4 gals.	51.4 gals.
Weight per gallon capacity	1.87 lbs.	1.53 lbs.
Shape of tank	Cubical	

These tanks consisted of an inner tank surrounded by cotton wool round which was wound a quantity of ordinary small mesh wire netting, more cotton wool, a netting of strengthening straps and the whole enclosed within a metal cover and more strengthening straps.

Tanks Submitted by Mr. Osborne, Fredensburg, Hammers Lane, Mill Hills

	No. 1	No. 2
Weight of tank	69 lbs.	69.25 lbs.
Capacity of tank	29.9 gals.	29.6 gals.
Weight per gallon capacity	2.32 lbs.	2.34 lbs.
Shape of tank	Cylindrical	

The tank was made of celluloid fitted with celluloid cage and baffle plates and strengthened with special celluloid girder work. It was enclosed in a specially built-up 3-ply cork container, which was then again enclosed in a special vulcanized india-rubber jointless cover.

Tanks Submitted by Mr. Penfold, c/o Sir John Jackson, Ltd., 53, Victoria Street, London

	No. 1	No. 2
Weight of tank	93.5 lbs.	99.5 lbs.
Capacity of tank	30.5 gals.	32 gals.
Weight per gallon capacity	3.06 lbs.	3.1 lbs.
Shape of tank	Cubical	

Each tank consisted of a rectangular welded aluminium container, the sides and back of which were corrugated, placed in a wire cage and tightly packed with asbestos fibre, and around the whole was an outer metal casing.

Tanks Submitted by Mr. Roberts, 32A, Mander Street, Wolverhampton

	No. 1	No. 2
Weight of tank	72 lbs.	72 lbs.
Capacity of tank	27.1 gals.	27.1 gals.
Weight per gallon capacity	2.65 lbs.	2.65 lbs.
Shape of tank	Cylindrical	

Each of the compartments of which the tank was constructed opened into a central tube within which was placed a liner capable of being turned so as to shut off the several compartments when the machine is descending in flames, so that in the event of a crash the fuel which is in the broken compartment only will leak and not the whole. The fuel container was enclosed in an outer shell, a liquid fire extinguisher being introduced between the two.

Tanks Submitted by Mr. Verhoeven, 118, Montignis, Chatilenau, Belgium

	No. 1	No. 2
Weight of tank	127.5 lbs.	124.5 lbs.
Capacity of tank	39.5 gals.	38.4 gals.
Weight per gallon capacity	3.23 lbs.	3.24 lbs.
Shape of tank	Cubical	

The tank consisted of inner and outer metal shells the space of approximately 1¼" between the two being packed with sheet cork.

The Giant Farman

The world's greatest biplane has just finished its final tests in the aerodrome at Orly and soon will commence trans-European flights. Probably it will be used in a new attempt to cross the Atlantic late this summer. It is of Farman construction, with four propellers and four 400-horse-power motors. The wing spread is more than 100 feet.

According to Aviator Boussotrot, its pilot, it will maintain a speed of 100 miles an hour while carrying twenty passengers and baggage—a total load in excess of seven tons. Although it was designed for passenger service, experts who examined it during the recent *salon d'aviation* declared it to be an ideal craft for bombarding cities from a great height in the event of another war.

Portuguese Airmen to Continue Flight

The Portuguese aviators, Capts. Saccadura and Coutinho, sailed May 9 from Rio Janeiro for St. Paul Reck from Fernando Noronha on board the Portuguese cruiser Republic.

The airmen took with them their new seaplane sent from Portugal on the steamship Bage, which was unable to land the machine at the Recks because of rough weather, bringing it on to Fernando Noronha. They expect shortly to resume their flight from Portugal to Brazil, cut short by the accident to their first seaplane in landing at St. Paul Rock last month.

Continental Air Couriers

The latest development in aviation is contained in an announcement that an Air Courier Service has just been put into operation between London and Paris. Mr. Ransley S. Thacker, a barrister who has for several years been interested in aviation work, is the one responsible for this new enterprise.

Mr. Thacker travels every other day by aeroplane to Paris, and returns in the same way next day. Shortly he may go to Paris and return on the same day. If the amount of business makes it necessary, and Mr. Thacker states that from his present experience it soon will be necessary, he will employ other couriers, who will be despatched by each of four daily services.

Mr. Thacker is prepared to transact business or to execute commissions of any reasonable nature, and we can imagine many and varied will be the missions which he will be asked to undertake.

Mr. Thacker's offices at Granville House, Arundel Street, Strand, are open day and night, so that instructions may for urgent reasons be made at any time during the night, and in order to develop this service to the full special night flying services will, it is proposed, later on be in operation; and in a short time it is hoped to have a Courier Air Service to Amsterdam, with connections to Berlin and Copenhagen, and also to Brussels, a direct service of couriers between London and Marseilles, and from Paris it will be possible to reach the most remote points by air.

The personal nature of this service is its *raison d'être*, and the commercial and legal experience and negotiating ability of its founder should be most valuable assets.

Mr. Thacker's charges vary from six guineas to ten guineas according to the nature of the transaction involved, but in any case it is considerably lower than the cost of sending one's own messenger.

It is shortly intended to open up offices in Paris, so that the business on that side may be developed also.

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NAVAL and MILITARY AERONAUTICS

A. S. O. A. Sixth Corps Area

Short talks on the problems of the Air Service in the next war and the types of aeroplanes that are being developed to meet these problems were given at the May meeting of the Air Service Officers Association of the Sixth Corps Area, in Chicago. The problems were presented by Lieut. K. T. Price, A. S. O. R. C., and the descriptions of the machines and instruments now being developed were given by Lieut. Dallas M. Speer, A. S. O. R. C.

Following their remarks Major W. S. Wood of the reguar army spoke for some minutes on Customs of the Service, and the necessity of maintaining a high degree of discipline. He emphasized the importance of insistence on a smart military salute as a big factor in maintaining discipline and morale.

Air Service Offers Opportunity

How can I become an Airship and Balloon Pilot and at the same time obtain a commission in the U. S. Army Reserve Corps? No doubt many young men, recently graduated from College or about to obtain the coveted sheepskin this coming year, would be interested in such a proposition and would be glad to grasp the opportunity if they knew it existed. There does exist such an opportunity and it is not limited to college men alone, but in many instances, where a man is possessed of a good High School education, the curriculum of which includes sufficient mathematics and science, he may, upon satisfying the Examining Board as to his qualifications, be admitted to the Air Service Balloon School as a cadet and candidate for a Reserve Commission.

The Army Air Service has established schools for the training of Airship Pilots and Balloon observers. The object of these schools is threefold, first: to provide an adequate Officers Reserve Corps; second: to educate the young men of modern times in Aeronautics, past and present, and the possibilities of aeronautics in the future; and, last, but by no means least:—to promote the science of commercial aeronautics. This last object will have a far reaching benefit if it is carried out as contemplated. Even at the present time commercial aeronautics has become a leading economic factor in some countries, and this country has far greater possibilities, due to the government monopoly which the Army Air Service has on the Helium supply in the United States.

The question may here be interposed, "Why should this have any bearing on the possibilities of Airships?" Helium is a non-inflammable gas known to exist in the southwest part of the United States, particularly in Texas. Although, admitting the highly inflammable character of Hydrogen Gas, there have been very few Airships destroyed, the cause of which can be traced either directly or indirectly to Hydrogen. Nevertheless, the known characteristics of this gas had at least a moral effect on the promotion of Commercial Aeronautics which the discovery of Helium alone can eliminate.

Extensive investigations have been carried on to determine the extent of Helium resources and considerable money expended to develop the equipment necessary to place this gas on a production basis.

A maximum monthly production of Helium is now possible, amounting to approximately 1,000,000 cu. ft., and it is safe to predict that future production as required is assured.

Some of the recently designed ships have a lift of between fifty (50) and seventy (70) tons, over all, or over the weight of the ship itself. The use of Helium will make ships of this type practically as safe for transportation as the present over-land express. A line of ships of this type from New York to Chicago, to St. Louis, to Omaha, to Salt Lake, to San Francisco is not a mere possibility, but within, say, ten years, it will more than likely be an actual fact. The airship today is in the same category as the automobile of 1905, and how many automobiles were seen on the streets in those days? Those who have prepared themselves for the situation will find ample opportunity for utilizing their knowledge when the airship takes its place among the approved modes of transportation, and upon them will fall the responsibility of success or failure of commercial aeronautics, and to them will go the rewards when success is finally achieved.

It is impossible, in the brief space allotted, to go into all the possibilities of the airship. All that can be expected is to arouse your interest in this all-important subject to the extent that you will not let it rest without further investigating its possibilities and deciding whether or not the predictions are logical: for those who agree that they are, the Government offers a course of instruction leading to a Reserve Commission at the Balloon School, Ross Field, California.

The course at this school covers a period about of ten (10) months, and includes primary training in Airships. An advanced course in Airship work is offered at Langley Field, Virginia, for those who complete the Balloon Observers' and Primary Airship course at Ross Field. This advanced Airship course covers a period of about six months, and when the cadet graduates he is competent to handle any Airship in this country at the present time. This advanced course at Langley Field is not necessary to qualify for a Reserve Commission as it is given on completion of the Balloon Observers' Course. While retaining a Reserve Commission in the Air Service, the qualified Pilot may, as the opportunity presents itself, continue his flying training by taking periodical flights in the craft he is eligible to pilot.

Cadets are paid at the rate of $75.00 a month, exclusive of board, lodging and clothing. Applicants are desired between the ages of 20 and 25, preferably not over 30, and unmarried.

The 103rd Division

Progress in the organization of the 103rd Division, Air Service, has been fairly rapid considering conditions. Other Air Service units will be organized later. They will come under the head of "Army Troops." Names and qualifications are now being considered and set aside for the 436th Pursuit Squadron, Pueblo, Colorado; 437th Pursuit Squadron, Deming, New Mexico; 438th Pursuit Squadron, Santa Fe, New Mexico, and 439th Observation Squadron, Phoenix, Arizona. No Corps Air Service troops or lighter-than-air units have been allocated in this divisional area.

A keen interest in Air Service activities exists among reserve officers. All that have been interviewed are anxious to get hold of the "old stick" again and make inquiries as to the possibilities of a fifteen-day training period. Some of them have shown enough interest to write their Congressmen in Washington urging them to make sufficient appropriation for the Reserve Training Camp and to sustain the four million dollar appropriation.

Captain Charles A. Pursley, Air Service, was assigned to duty with the 103rd Division, Air Service (8th Corps Area) with station at Colorado Springs, Colorado. Two rooms in the Federal Building at Colorado Springs are set aside for the headquarters of this Division.

Captain Pursley, in his endeavor to obtain a suitable flying field at Colorado Springs or in the immediate vicinity, has invited recommendations as to a site from the Chamber of Commerce, civic organizations and citizens of the community. He has already inaugurated a publicity campaign.

Further Tests of MB-7

Pilots at Mitchel Field had the pleasure, during the week ending April 15th, of watching the little Thomas-Morse Monoplane MB-7 make test flights. Lieut. Flier, U. S. Marine Corps, the pilot, put the little ship over a measured course. The time for the flight has not been officially given out and the speed is not known. The pilot estimated, however, that the little plane made well over 190 miles per hour. This ship is a monoplane with a wing spread of only 16 feet, is powered with a 300 h. p. Wright motor, and consequently has a very high landing speed. Thus far the pilot has successfully flown the monoplane on numerous occasions without the slightest mishap.

Reserve Officers Visit Kelly Field

Reserve officers from all branches of the service visited Kelly Field on April 7th in charge of Major Thomas Duncan and Lieut. W. A. Morris. This party, about sixty in all, witnessed the formation of DH's and XBIA's. Major Reynolds, commanding officer of Kelly Field, guided the party down the line, describing each event that took place. Much interest was exhibited in the GAX and its possibilities. An exhibition flight in this plane was made by Captain Shea to demonstrate the psychological effect of a low, harassment plane on ground troops. All left with a feeling that such a plane would be rather disturbing.

April Flying Record at Carlstrom Field

Records of the Flying Office at Carlstrom Field show a total of 2,439 hours and 50 minutes flying time for the month of April, 1922. This time was flown in the following type ships: JN4-6 Curtiss, DH4B, Vought, Spad, Thomas Morse and Nieuport.

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ELEMENTARY AERONAUTICS and MODEL NOTES

The Design of Model Propellers

An outline of the practices of the Illinois Model Aero Club

THE propellers on a model aeroplane transform the energy stored in the rubber into mechanical energy for overcoming the drift or the resistance of the machine as it passes through the air. The amount of thrust given by the propellers has very little effect upon the speed of the model as the formula, $speed = (weight\ \% \div surface \times Ky)^{1/2}$, will show. The excess in thrust, i. e., the thrust that is not directly used in overcoming the drift of the model, forces it to climb. As Ky or the lift coefficient of a given model wing varies but very little during its flight, the speed of a given model is nearly constant throughout its flight, the excess in thrust at the beginning causing a quick rise then, providing, of course, the model is properly powered.

The area of the model wing should be reckoned from the speed of the propellers rather than vice versa. The frame and propellers should be first built and assembled; then as much rubber put on the frame as it will stand for all-around flying. (And remember a flying model is not doing its best unless the frame is loaded till just below the breaking point with rubber.)

Then the rubber should be wound full and the average R.P.M. until the rubber is about one-half unwound taken. This used in the formula $R.P.M. \times Pitch \times 60 \div 12 \times 60 \times 100 = 8$ (*total weight divided by x or the unknown area in square feet*) ½ will give the area needed for the propellers used.

The aim in the design of a model propeller should be efficiency. Up to a certain extent, with all other things equal, the larger the propeller the more efficient it will be, for the end loss grows relatively smaller as the propeller grows larger, and also the larger propeller is not so likely to be working in air disturbed on a previous revolution.

Unfortunately, however, there are some serious limitations as to the size of model propellers. They cannot be too large on a twin-push or the frame will be so wide that the efficiency gained in propeller design will be lost in the inefficient angle of thrust. Slight overlapping of the circles described by the propeller blades on a twin-push is advisable, but must not be overdone. On a hydro, the larger the propeller the higher the machine must set from the water, and the hydro model that is set high above the water is not likely to be a record breaker. In this connection a four-bladed propeller, while a hard thing to construct and not efficient unless of a high pitch, has nevertheless made an efficient model.

For the same reason that propellers should be large, the blades should be narrow and the same limitations prevail. The tips, where possible, should be narrow with the widest part of the hlade about 65% of the distance to the tips. Sweeping tips are advisable except that such tips usually split easily.

In the securing of efficiency the blades of a propeller must have a true or constant pitch; that is, the pitch must at any point on either blade be the same, for when the propeller turns around every part of the blade should have a tendency to go forward exactly the same distance. To make this possible, the angle of a hlade must become greater and greater as the hub is approached, reaching an angle of 90 degrees at that spot, for as the blades turn about the tips travel through a larger circle than points nearer the hub and such points must go forward at a proportionately greater angle to keep in pace, so to speak, with the outer part of the blade.

In a carved propeller there are several ways of getting a true pitch, but the easiest and most satisfactory is to carve the propeller from what is known as a Wright blank, patterned from the original Wright aeroplane propeller.

That the pitch of a propeller carved from such a blank would be true and constant can be easily shown. The formula for calculating pitch, taking the measurements from either end of the blank, is, *pitch equals phi-D thickness divided by the width.* Then if the pitch is true P must equal the same thing for any spot on either blade. Let X be the distance of any spot from the center, then the pitch at that spot would be $pitch = phi\ (d - 2X)\ (thickness \div (W\text{-}D - 2W.\ X^3\!/_4D))$. Putting the values for P equal to each other, then, $phi\ D\ T/W = phi(D - 2X)T \div (W\text{-}D - 2W\ X/D)$, which, being an identity, shows that a propeller carved from a Wright blank will have a true helical pitch.

However, if the builder wishes to construct a bentwood propeller, then the pitch must be made constant by a different method. Finding the correct angle at a number of spots on each blade by means of a geometrical construction is perhaps the easiest method. The proper angles once found are transferred to the propeller by means of templates.

It must not be understood that either of the above methods will give an absolutely true pitch in practice. Only an approximation to a true pitch can practically be obtained because of variations of the lift and drift coefficients, i. e., parts of the blade nearest the hub which revolve at a high angle are less efficient than the part farther out which revolves at a lower angle. Some of this departure from the helical can be obviated by increasing the depth of the section as the hub is approached, which is usually done anyway to obtain the desired strength.

The size of the propeller to be used on a given model should be estimated from the size and strength of the frame. On a twin-push the propeller should be as large as the frame permits with a slight overlapping. On a tractor the diameter of the propeller is left to the discretion of the builder. The pitch of the propeller on a twin-push is usually about 1½ times the diameter, and a little less on a tractor, although this is largely left to the choice of the builder. Some model builders always carry two sets of propellers with them for each model, one set having wide blades and the other set having narrow blades, while the pitch and diameter are about the same; this allows them to make the most of the existing conditions at the flying field.

As has been stated, the pitch of a propeller can be found from the dimensions of the block from which the propeller was carved by means of the obviously true formula: *pitch equals phi-D.* $(T \div W)$. In laying out a blank from which to construct a propeller, a certain pitch is usually desired, as is the diameter and width (for whether narrow or wide blades are desired should have been previously decided). Then the thickness alone is lacking. Transposing, we obtain: *T equals phi*: $W \div$ *phi-D.*

Of the general methods of constructing propellers, i. e., carving and bending, carving is the method now in vogue, although the British have had some sensational success with the other method.

The Illinois Model Aero Club

By Joseph Lucas

The Illinois Model Aero Club was founded during January, 1912, to popularize and study the science and art of aviation through model aeroplanes. This organization was one of the first madel aeroplane clubs to be organized in the world, and it has advanced steadily while many other similar organizations formed later have fallen by the wayside. At present it is in its ninth year of successful operation.

Since the first model contests were held early in 1912 up until the present time the club has progressed until it now holds nine of the ten world's records recognized for models of the rubber-driven type. In addition to holding these records the club is the permanent owner of the Villard Trophy as a result of having won the National Model Aeroplane Competition three consecutive times. This competition consisted of a series of contests each year in which clubs from all over this country were entered. Practically all of the individual prizes, as well as the Villard Trophy, were won by members of this club.

From these facts it is easily seen that the Illinois Model Aero Club has been very successful in its work, and it is desired to continue this success by helping all who are interested in model flying or in aviation in general, and by popularizing this game throughout the world. It must be brought to as high a standard as possible and gain that high degree of respect and consideration which it deserves. There never was a mechanical field which held so much fascination for boys, not even the wireless craze, that model building and flying has not surpassed. There can be no doubt that all its effects are beneficial, not only to the brains and hands of the model builder but to those leaders in the aviation world who welcome suggestions by model experimenters.

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RADIO DIGEST

Radio Tells Aircraft Altitude

The uses to which wireless is being put on aircraft apart from ordinary communication are yearly becoming more impressive. The latest idea is to use wireless for informing the aeroplane pilot of his exact height above the ground.

Two methods are under consideration. The first makes use of the noise of the engine, which is caught in a series of microphones on the ground, enabling the height of the machine to be ascertained and transmitted to the pilot by wireless. In the second use is made of a proximeter, acting upon the principle that when electrical oscillations are set up in a circuit the frequency of these oscillations depends upon the electrical capacity and inductance of the circuit.

Radio to Join Five Countries

On returning from the International Radio Conference yesterday Edward J. Nally disclosed the fact that a new radio service that will link five nations together was one result of the gatherings in Cannes, Paris and later in London.

The conferences were carried on under the auspices of the Commercial Radio International Committee, and this agreement has been made between representatives of companies of England, France, Germany, United States and South America.

The new circuit will be operated in New York, Paris, London, Berlin and Buenos Aires. Mr. Nally, who is the president of the Radio Corporation of America, came back on the steamship Homeric after several weeks abroad attending the conferences. He told *The Evening World* that many important questions affecting the development and operation of wireless were considered and satisfactorily settled; in particular, the questions dealing with the extension and development of worldwide telegraph and telephonic communication.

The first of these new international services will be in Argentina, where a super-powered station is now in course of construction and which will be completed soon. It will be located near Buenos Aires and will be capable of transmitting and receiving simultaneously with the stations to be erected in this city, Paris, London and Berlin.

Another conference will be held by technical experts of committee in Berlin late in June to conclude the worldwide connection of other countries by wireless.

Mr. Nally said that the people in Europe are intensely interested in the development of the radiophone and broadcasting service in the United States. Owing to existing laws their many difficulties will have to be overcome by several of the governments before broadcasting is done on the same broad plane as in the United States.

Progress Rapid in Sea Radio

There has been a great change in the mode of communication to and from steamships through the radiophone discovery. The first transatlantic steamship upon which a wireless telegraph apparatus was installed was the St. Louis of the American line. It was installed by Guglielmo Marconi, the inventor, who superintended the work from the top deck in November, 1899, when the St. Louis was making her fifty-second voyage eastward toward Southampton. Communication with the English shore was established when the vessel was sixty-six miles from the Needles. Today great wireless towers are able to flash messages half way around the world by telegraph and every modern steamship is equipped with both the wireless telegraph and telephone apparatus.

Some of the larger vessels are enabled to receive messages in the telegraph code from a distance equal to the width of the Atlantic, but for sending their transmitters will not carry so far. However, with the present telegraph system, a traveler during a transatlantic voyage may communicate with the shore at any time that other ships are willing to relay messages.

That this same system may be further embellished by the radio telephone is now the hope of the various big broadcasting companies who are making the tests with both incoming and outgoing steamships and at the same time making history.

A Warning to All Radio Phone Fans

If you are a radiophone fan—and if you aren't you must be the man Bob Davis once described as "the most extinct of his species"—if you are one of the growing thousands who get companionship, knowledge and recreation out of the little black box, be prepared for an explosion. While you are about it better get prepared for a lot of explosions. They'll be coming along with the first hot weather, says Ernst F. W. Alexanderson, chief engineer of the Radio Corporation of America, in an article, "The Imp in the Radio Box," in *Collier's Weekly* for May 13. He warns that these explosions will raise so much ruction that the radiophone owners switching in for their nightly concert will feel "as if they had been put into a steel tank against which a husky regiment of boys was throwing tons of everything, from buckshot to paving stones."

These explosions, Mr. Alexanderson explains, are first cousin to the lightning. Their other name is static. Mr. Alexanderson writes:

"This summer the new owners of radio apparatus will have to learn the fact which amateurs have long known—that their sets will give only about half normal service during hot weather. It will depend a good deal on the location of the receivers with reference to the sending stations. Those within about twenty miles of the broadcasting centers should be able to hear signals and conversation and music most of the time, though often with a background of rumbles and cracks. Those farther away will hear proportionately less. It will be seldom indeed that it will be possible to receive from stations several hundred miles away, as has been done by many during the winter. This is true of radio receivers of all kinds. The static imp plays no favorites."

But there are ways to beat the static imp. One is to run a straight wire about 400 yards long (which corresponds with the radio broadcasting wave length) in the general direction of the station from which signals are to come. If you cannot command such magnificent distances for your aerial you can rig up one of the "loop" type—a long wire wound several times around a vertical wheel, and turn the rim of the wheel toward the sending station. Much can be accomplished also in eliminating static by sharp turning.

Most of us, Mr. Alexanderson says, will have to wait for cold weather to come again before we are real happy with our radiophones, but he promises that by the time another summer comes around the radio experts will have made a big advance toward the solution of radio's biggest present problem.

Radio Set Acts as Barometer

Many experienced radio enthusiasts are able to predict, with a fair degree of accuracy, the advent of cloudy or rainy weather. When the static in the air is particularly heavy, which is evidenced by a loud hissing sound in your receivers, you may be quite sure that bad weather is close at hand. This may be observed on small crystal sets as well as on more elaborate apparatus.

Europe Interested in U. S. Radio Progress

The people of Great Britain and the countries of Europe are viewing with great interest the strides made by the United States in the use of the radio telephone and are preparing to develop the newest wireless invention on a similar scale, according to Edward J. Nally, who is president of the Radio Corporation of America and who returned to the United States from abroad this week.

Broadcasting will encounter a number of difficulties in Europe which have not faced the pioneers in the United States, Mr. Nally said, because of the small size of some of the nations, the varying languages and laws of restriction which may be made in respect to sending messages across national boundaries. Great Britain has already started broadcasting, however, as have France and Germany. The latter country has already established an extensive financial and general news service, which is being broadcasted to a number of places in Holland, Denmark and other of the smaller neighboring countries.

"The people of the European countries," said Mr. Nally, "are extremely interested in the reports being published there of the surprising development and extension of the radiophone in the United States, and are preparing to deal with it. Owing to existing laws there are many difficulties to overcome in the way of limiting regulations and restrictions with probable interference among the several countries, however."

Mr. Nally attended the conferences of the Commercial Radio International Committee, which were held in Cannes, Paris, and later in London. Representatives of the Radio Corporation of America, the Compagnie Generale de Telegraphie sans Fils of France, the Gesselschaft fur Drachtlose Telegraphie M. B. H. of Germany, and Marconi's Wireless Telegraphy Company, Ltd., of Berlin.

The head of the Radio Corporation said that plans were under way for the immediate construction of wireless stations in a number of localities, particularly in South America. Through agreement between the four companies of the Inter-

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national committee service for commercial purpose was to be improved materially in the near future. One of the large stations is already in the process of construction in Argentine and will transmit and receive from similar places in New York, Paris, Berlin, and London.

"The conference," said Mr. Nally, "considered the extension and development of wireless communication generally and it was agreed that, in order that commercial wireless telegraphy and telephony should be developed to the best advantage in the interests of the public and of international commerce, in the construction of wireless stations every care must be taken to avoid interference. It was decided that the four companies shall not erect and will not view with favor the erection by others of any stations which will entail the radiation of harmonics or secondary waves beyond the agreed distance outside the limits of the definite wave bands allotted to each particular station."

Business Men Form National Radio Council

A National Radio Chamber of Commerce has been organized for the purpose of remedying some conditions which have arisen in the radio industry as an inevitable result of the over-rapid growth of the industry in the past months and to group together manufacturers whose radio products are of such dependable character as to maintain favorable public opinion toward the radio industry.

It is stated that eligibility to membership will depend, not on the size of a concern, but rather upon the quality of the product manufactured. The original group consisted of about fifteen manufacturers. New members will be added to this body by invitation, to the number of about twenty additional concerns whose business standing and products are known to be of a high order. The quality of the products of candidates for membership will be determined upon by a board of five members.

The Radio Chamber of Commerce plans shortly to organize a Credit Bureau for the interchange of credit information.

At a meeting recently held in New York plans were outlined and the following officers elected:

President, Alex Eisemann of the Freed-Eisemann Radio Corporation; first vice-president, Charles Keator of the De Forest Radio Telephone and Telegraph Company; second vice-president, William Dubilier of the Dubilier Condenser Company; secretary, Frank Hinners of the Home Radio Corporation, and treasurer, Joseph D. R. Freed of the Freed-Eisemann Radio Corporation.

Women Form Radio League

The Women's Radio League of America, Inc., held its first annual meeting on Tuesday evening, May 2, in room 907 Y. W. C. A. Building, Fifty-third street and Lexington avenue.

The following officers were elected: President, Miss Abbie Morrison; vice-president, Mrs. Eleanor G. Regan; secretary, Mrs. J. Koch; treasurer, Miss Elizabeth Rhodes.

The regular meetings of the league are held on the first and third Tuesday evenings of every month at the above address. Code practice for those who wish it is at 8 p. m., business meeting at 8:30 and the speaker of the evening at 9.

At the next meeting, on May 16, A. H. Hebert, an official of the American Radio Relay League and member of the second district executive council, will speak on "Co-operation and Organization."

All women interested in radio are invited to attend these meetings, and if desired courses in radio telegraphy or telephony can be arranged for.

State Police to Get Radio

The superintendents of state police of the states of New York, Massachusetts, Connecticut, Pennsylvania, New Jersey and Michigan, in conference in New York, seriously discussed the advisability of equipping their stations with radio systems. A system has already been installed in Pennsylvania which will be officially tested this week.

Book Reviews

Two very good books have been sent in this week by the Technical Book Company, New York. Both books are written by an author whose technical works have had national indorsement, James R. Cameron. The first book is "Radio for Beginners." This volume treats in an understandable manner the subject of radio, from the theories of elementary electricity to the adjustment and operation of the different types of modern receiving sets. A number of outfits being supplied by the larger radio concerns are described in detail, and instructions for getting best results out of these sets are also given. The other book is the "Radio Dictionary," a little book containing a wealth of material. All the terms usually met with in radio, electricity, and allied subjects are simply defined. Both books would make a valuable addition to any beginner's library.

The James A. McCann Company, 188 West Fourth street, New York, offers a very good book at a very reasonable price. It is "Amateur Radio," by Maurice J. Grainger, radio expert, formerly with the Westinghouse Electric Company and the United States navy. It opens up with the fundamentals of electricity and leads on to practical operation and theory of the most advanced amplifier sets. Each piece of apparatus is explained in an understandable manner. Near the end of the book is given a glossary of the most important radio terms, and also valuable information concerning time signals and radio laws and regulations.

A little book of merit, "Radio Made Plain," by John D. Haskell, is published by the Radiox Associates, 222 Charles River road, Cambridge, Mass. This little book presents in question and answer form a most useful and interesting mass of data needed by the newcomer in the radio game. Equipment, installation, and use and radio terms are treated in regular order. A quarter buys it.

Proper Tuning Big Factor in Radio Receiver

Tuning of the receiving to the beginner is a thing that has a lot of mystery connected with it. The question has been asked, "How do you know where to pick up the desired signal?" There is no way to tell on a set that the amateur is not familiar with. But, after the set has been in operation for a little while, the beginner will soon learn exactly where to pick up the desired signals. Most sets have dials on them that are divided off into 180 degrees with the numbers engraved on them for every ten degrees. These numbers have nothing whatsoever to do with the wavelength of the station, but are simply put there to enable the operator to remember easily at what point a station will be heard. Usually the lower numbers represent the short wavelengths and as the dial is turned about the longer waves will be heard.

With most sets it is a very simple matter to soon learn exactly where the desired signal may be heard, and the set may be left in the same setting all the time if it is used just for receiving the broadcasting. In other words, the set is tuned to receive the music from W J Z, and there is no necessity to move the knobs again unless other stations are wanted.

The theory of tuning is a long and complicated study, and a few words on the subject may clear up a lot of misinformation. In the first place, every transmitting station has a certain wavelength upon which the transmitted signals or voice is transmitted. The receiving set, however, is capable of receiving several wavelengths by turning the knobs about. A transmitter can also be made to transmit on several wavelengths, but cannot be tuned as fast as receiver. When your receiving set is tuned to receive a certain transmitting set it is in resonance with the other station. A simple way to explain this is to say that the wave lengths are very nearly the same. This is accomplished by adding or subtracting a certain number of turns of wire in the coils and thus equalize the wavelengths of the two stations. By the addition of different pieces of apparatus it is possible to make this tuning very sharp, and there are some sets that will receive the desired signals only. However, these sets are very expensive and the operator has to be an expert. The average amateur set will not tune sharp and a great deal of trouble has been caused by some beginners filing complaints about some amateur spark transmitter. Usually the spark transmitter is tuned to a sharp wave and is operating legally, while the beginner's set is the one that is at fault, as it is incapable of sharp tuning. If more beginners would study up on these facts before purchasing a set there would not be so much interference. Many amateurs have home-made receiving sets with which it is possible to sit and listen to W J Z all the evening without hearing a single interfering station.

Of course, there are certain cases where it is impossible to tune out the unwanted station with any set. Some amateurs are unfortunate enough to be located very near one of the naval or ship stations, and it is impossible to do any tuning, owing to the close proximity of the transmitter. When buying a set ask for a demonstration showing the selectivity of the set, as by doing this the beginner will save himself a great deal of trouble in the future.

Lift and Drag Effects of Wing-Tip Rake

This report (No. 140) by A. F. Zahm, R. M. Bear, and G. C. Hill of the National Advisory Committee for Aeronautics deals with a description and report of tests carried out at the Washington Navy Yard on models of the RAF-6, Albatross, the Sloane aerofoils to determine the effectiveness of the conventional wing-tip rake in improving aerofoil characteristics. Two degrees of rake were tested on each model; the trailing edge being always longer than the leading edge. The results are compared with the values computed by standard formulae in use at the time the tests were conducted.

A copy of Report No. 140 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Personal

Major B. M. Atkinson, A. S., returned from the Letterman General Hospital on May 4th, and again assumed command of Mather Field.

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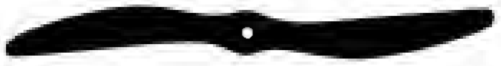

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(Concluded from page 243)

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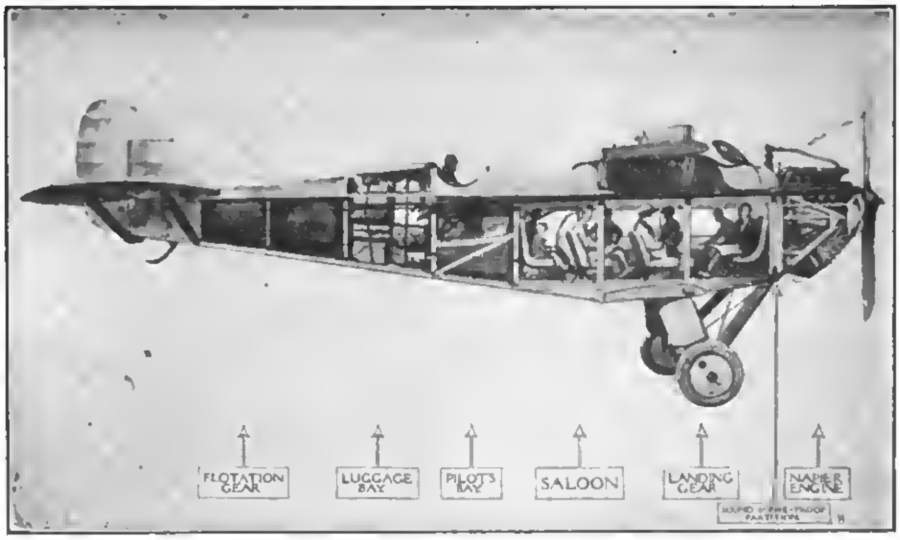

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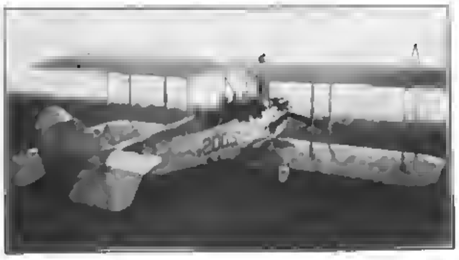

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JUN 5 1922
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AERIAL AGE
WEEKLY

VOL. 15, No. 13 JUNE 5, 1922 10 CENTS A COPY

Including Radio Section

Section of Chicago, Showing the Wrigley Building in the Center. Photograph by Whitney Spear & Co.

The Flight Around the World—Commercial Aviation Development in the United States

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GOODYEAR

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June 5, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 13

TABLE OF CONTENTS

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

With which Flying is consolidated

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VOL. XV NEW YORK, JUNE 5, 1922 No. 13

The Flight Around the World

MAJOR Wilfred Blake and Capt. Norman Macmillan set forth on their historic around-the-world flight on May 24. The Aircraft Disposal Company has, with commendable sporting spirit, placed four machines at their disposal, and the project appears to give fair promise of success. The machines to be used, although not of new types, have stood the test of time, and, given reasonable luck, the aviators should have a very good chance of getting through. Although as a sporting effort the use of a single machine for the entire flight would have been more spectacular, the employment of four machines, of three different types, will be a much closer representation of the actual conditions which will obtain when we come to run really long-distance services, and from that point of view is, perhaps, of even greater practical value.

Two of the machines will be DH9's (three-seaters) with Siddeley "Puma" engines. One will be a Fairey twin-float seaplane of the famous F. III type, which has a Rolls-Royce "Eagle" engine, and the fourth will be a flying boat of the F type.

In the main, the route to be followed by Major Blake and Captain Macmillan will be the same as that planned by Sir Ross Smith. The last "leg," however, will be different from that planned by Sir Ross Smith, who, it will be remembered, had intended to make the Atlantic crossing direct from Newfoundland to Ireland if possible, or, as an alternative, fly from Newfoundland to London *via* the Azores and Portugal. Major Blake and Captain Macmillan intend to follow the northern route *via* Greenland, Iceland, the Faroe Islands and Scotland, which will considerably shorten the non-stop stages that have to be negotiated. At the time of year when it is expected to cover this part of the flight the weather in the northern latitudes should be favorable, except for local fogs, and by taking this route the strain on the engines should be considerably reduced.

The manner in which it is intended to use the various machines is as follows: One of the DH9's will be used for the journey from London to Calcutta. Here the aviators will change over to the Fairey F. III seaplane, which will take them around the coast up to Kamchatka and across to Alaska. Here another DH9 will await them, on which the flight across Canada and America to New York will be accomplished. From New York or Newfoundland the last stage, across the northern part of the Atlantic, will be attempted in the F. boat.

This, in very brief outline, is the plan of Major Blake and Captain Macmillan, and, barring unforeseen accidents, the scheme promises success. That difficulties will be met and obstacles have to be overcome goes without saying, but there is certainly a very good chance of getting through. All the machines to be used, although of fairly old type, have been proved by years of flying under all sorts of conditions, and should be capable of the stages on which each is being used. The engines also have proved themselves in numerous long-distance flights, and may be expected to uphold the reputation already established. Captain Macmillan is one of our best pilots, and has had experience of a number of different types of machines.

Altogether, the scheme looks promising, and we wish the gallant aviators every success in their very sporting attempt.

Dine in London—Sup in Paris

THE night flying route between London and Paris was recently inaugurated by Major-General Sir W. S. Brancker, Director of the Air Ministry, and Lieut.-Col. Lyster F. Blandy, in charge of communications for the Ministry. The new service, using Handley Page machines, will be known as the Starlight Airway Route, and promises to be another historic step in the progress of aviation.

When the route is regularly operated, which will be soon, it will be possible for a party to dine in the West End of London and get a midnight supper on the hill of Montmartre in Paris. It will follow the regular continental air path and signal lights will be aglow at all the airdromes along the line.

Discussing its possibilities, Col. Blandy said: "Night flying from London to Paris is sure to come as an established service because its advantages over the present means of transport by rail and sea are obvious.

"By this means we hope in every way to develop trade, and we believe that passengers will come to regard the starlight route as the ordinary way of getting there. Certainly it will be the quickest and the pleasantest; and, if not the safest, it will at least be equally safe as any other way. It should appeal strongly to business men who cannot afford to waste a day or a night with its inconveniences of traveling. We are demonstrating to the public the extraordinary possibilities of night flying."

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THE NEWS OF THE WEEK

Propose Air Freight New York to Chicago

The War Department is asking information as to the probable volume of traffic available for the support of an air line for commercial transportation between New York and Chicago. The Government disires to promote the commercial use of aeroplanes so that the development of aeronautics in this country may keep pace with the advance in other countries. Congress is now considering two phases of the subject—air mail service and commercial transportation by aeroplanes.

Major General Mason M. Patrick, Chief of Air Service, in a letter to William Fellowes Morgan, President of the Merchants Association, requests that the association aid in obtaining information sought in the proposed extension of air lines with Government co-operation.

"In accordance with the announced policy of the President and of the Secretary of War to encourage the early development of civil aeronautics," says the letter, "this office has under investigation the possibilities of civil aircraft operating as a transportation agent along organized routes. In particular, an organization to permit daily overnight transportation between the industrial communities of New York and Chicago is being considered.

"It is of first importance to determine as accurately as possible what the average daily volume of traffic would be which would utilize overnight air transportation if it were so established that the reliability and safety of service were comparable to present-day railroad standard. Merchandise and express will probably be collected in the downtown districts of New York and Chicago between 6 and 7 P. M., with delivery the following morning in the opposite city between 7 and 8 o'clock. It will be necessary to charge probably between $1 and $2 a pound, at least during the development period. To assure absolute reliability will require a very thorough organization of ground, navigational beacons and landing fields, for which it may be possible to gain generous Government support, if it can be demonstrated that the service contemplated will fill a sufficiently important business demand.

"Your association is in a position to render a valuable service to this office if you will undertake to determine what the probable volume of business will be which will patronize an air transportation service such as outlined at the rates suggested. It is the desire of the Government to encourage these activities in civil aeronautics which will most directly bring about the creation of a self-supporting aeronautical industry and the co-operation of your association to that end will be appreciated."

The association, in commending the request to the consideration of its members, asks a statement from them of their views as to the utility of the proposed service, together with an estimate of the quantity of traffic which each one probably will be able to supply to the support of the line. The data will be transmitted to the War Department in accordance with the request of Major General Patrick. While it may not be possible, the association adds, for every member to estimate accurately the extent of the traffic which he could supply, it is nevertheless probable that many merchants could make an approximate estimate of the extent to which they could use the proposed transportation agency, and urges that this be done.

Fokker in America

A. H. G. Fokker, Dutch aeroplane manufacturer, reached port May 28 on the Holland America liner Nieuw Amsterdam, bringing with him two new planes which will be used in this country.

Mr. Fokker said that it would soon be as safe or safer to travel in aeroplanes than in street cars. Every one in Europe now is using planes as they use automobiles, and the companies operating aeroplanes have had to establish waiting lists.

The inventor is here for a visit of two months to look into the use of his planes in this country.

Greater Safety for Air Travellers

Pending the enactment of legislation for the regulation of air navigation the National Advisory Committee for Aeronautics in a resolution adopted recently calls upon the operators of aircraft to voluntarily equip their aircraft to promote the safety and comfort of passengers. It is the Committee's opinion that the suffering and loss of life attending forced landings of aircraft on land or water can in all probability be lessened by making use of existing knowledge and facilities. To this end the Committee urges "that large seaplanes should be provided with wireless and other signaling equipment, be seaworthy as well as airworthy, and carry at all times fire extinguishers, life preservers, a first-aid kit, and a supply of food and fresh water; that aeroplanes operating over the land should carry wireless or other signaling apparatus, fire extinguishers, and a first-aid kit." It is understood that the accident to "Miss Miami" in which four persons lost their lives, for want of reasonable precautions to provide for the safety of air travellers, prompted this action by the National Advisory Committee for Aeronautics. Legislation for the regulation of air navigation is now pending in Congress. A bill introduced by Senator Wadsworth to create a Bureau of Civil Aeronautics in the Department of Commerce has already passed the Senate.

Round the World Flight Starts

LONDON—Major W. T. Blake, Captain Norman MacMillan and Lieut. Col. Broome started May 24 from the Croydon aerodrome in an attempt to fly around the world. They are using a DH19 aeroplane, and hope to complete the journey in about ninety days, reaching Croydon on Sept. 7. Their route as planned is 30,000 miles long.

Major Gen. Sir William Brancker, Director General of Civil Aviation, attended to wish them good luck, and a message from the King and Queen was handed to Major Blake as he stepped aboard the aeroplane: "Their Majesties wish you all godspeed and good luck."

Major Blake's wife and little daughter Barbara, as well as his father and mother, came to see the starting. His wife handed him a black cat mascot as she kissed him good-bye.

Enthusiastic cheers were raised by a large crowd of well-wishers as the aeroplane left the ground.

Navy Launches Fighting Planes With Passengers From Ship Deck

The Navy Department announced the successful experiment of launching the service type of seaplanes from the decks of vessels by use of the catapult. The planes are powerful enough for both observation and fighting purposes.

The experiment was made from the deck of the battleship Maryland, the country's most powerful sea fighter, at Yorktown, Va., on May 24.

This is the first time it has been possible to launch an effective plane carrying passengers and well weighted. Heretofore the experiments have been with small and unserviceable planes without loads.

The success of the experiment is regarded by navy officials as the means of meeting the menace to battleship by attack from the air and is the defensive reply to the air offensive demonstrated in the recent bombing experiments of the army and navy.

It is interpreted by the experts as meaning that the battleship remains the fighting unit of the navy, which aims to equip every battleship with the mechanism necessary for launching a fighting airship while at sea.

The project of catapulting planes from a ship was effected first in 1915 on board the North Carolina, followed in 1916 by further experiments on the Huntington.

Flight of 1,000 Miles at 110 Miles an Hour

Washington.—Major Roy C. Geiger of the Marine Corps is believed to have broken the record for time and long-distance North and South flying May 27 between Quantico, Virginia and Pensacola, Florida, in a D. H. D.-4 Marine Corps type plane with a Liberty motor.

Major Geiger left Quantico, thirty miles south of Washington, at 4:40 A. M. and arrived at Pensacola at 3:30 in the afternoon. This time included approximately two hours of stop-over, making the actual flying time less than nine hours. The trip was made at an average speed of about 110 miles an hour over a distance estimated at 1,000 miles.

Two stops were made, the first at the Army Aviation Field at Fayetteville, N. C., for an hour and a half. During that time the plane and motor were inspected and oil, gas and water obtained. The second stop was at Americus, Georgia, for about half an hour while the tanks of the machine were being recharged with gas. Major Geiger carried Sergeant John Belcher with him on the trip and about fifty pounds of baggage.

Experts at Marine Corps aviation headquarters said that Major Geiger's time was undoubtedly the fastest ever accomplished between Quantico and Pensacola, where the country to be covered is broken and difficult to negotiate. They said the speed for the journey was phenomenal and they believe that Major Geiger may have broken the world's record for speed over that distance.

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The AIRCRAFT TRADE REVIEW

Huff Daland Aeroplanes at McCook Field

A great deal of interest has been aroused at McCook Field in the two types of Huff, Daland and Company's thick wing biplanes now under test by the Engineering Section of the Air Service.

This company has been specializing in the manufacture of very simply constructed aircraft which use the Gottingen 387 thick wing and are remarkable for the liberal use of plywood and steel tubing in their structure. At present there are two types of planes at McCook.

The first type, which has already been flown and is now undergoing its official performance tests, is the OX5 motored two or three place, officially known as the HD8A, which this company is marketing under the trade name of PETREL. This plane is a development of the Anzani motored machine with the same wings which was flown by Lieutenant Harris last Fall. Its makers claim a top speed of ninety-three miles per hour and a landing speed of less than thirty five with a total useful load of seven hundred and thirty six pounds. Insomuch as the entire surface of the plane is less than two hundred at thirty square feet, this performance is considered very remarkable.

The PETREL has been very thoroughly tested as regards its structure. Its radiator has been flow tested. Its propeller has undergone an endurance test at 1800 RPM. Its struts have been pulled in an Olsen machine, and aside from a few minor changes, the plane has been approved as manufactured. This plane is now undergoing its performance tests, and figures will be issued shortly. Up to the present no attempt has been made to check the figures which resulted from the manufacturer's tests at Ogdensburg, but Captain McCready reports that the PETREL as flown last week is very easy to control, which is one of the manufacturer's chief claims.

The second type of plane which this company is manufacturing for the Air Service specifications, is a smaller version of the PETREL, with 176 square feet of surface and the 140 HP Model R nine cylinder Lawrence motor. The plane has the Gottingen wing, but unlike the PETREL its wing is tapered upward in thickness and forward from the center of the trailing edge in chord for greater speed. The ship is designed as a pursuit training plane and is claimed to have all the flying characteristics of a single seater service machine, together with a low landing speed and high safety factor. In appearance it shows much thought in its perfect stream-lining, large angle of attack when landing, and general clean appearance. In regard to surface and loading it is similar to the fifteen square meter Neuport which was considered the most maneouverable aeroplane of its class by pilot's who went through the French pursuit schools overseas. However, it should be remembered that this plane is powered with 140 HP.

Huff Daland and Company claim for their Lawrence plane a high speed in excess of 120 MPH, in addition to its maneouverability and low landing speed, so that the official tests on this two seater will be of utmost interest.

The results of the performance tests on both these planes will be published in these columns as soon as such publication is authorized.

Curtiss Oriole for Capt. Roald Amundsen's North Pole Expedition

ONE of the most important pieces of equipment which left Seattle with Capt. Roald Amundsen's North Pole expedition on the three-masted schooner "Maud" is a stock Curtiss "Oriole" with a Curtiss C-6, 160 h.p. motor, equipped with electric starter. This plane was presented to Capt. Amundsen by the Curtiss Aeroplane and Motor Corporation and christened at the Curtiss Flying Field, Garden Ctiy, L. I., on April 6, 1922, and now bears the name "Kristine." The fact that Capt. Amundsen has equipped his expedition with a modern aeroplane shows that he appreciates the advantages to be gained by this means of transportation. It is his plan to drift across the Polar Basin in the vicinity of the North Pole with the Schooner "Maud" and during the passage make exploring and mapping trips in all directions radiating from the supply ship, using the ship as a base. By doing this it will be possible to cover a vastly greater area of country and to secure photographs from which can be produced an accurate map of the country giving both the geography of the territory and the general condition of the terrain.

Capt. Amundsen has secured as his pilot Lt. Oskar Omdal, formerly of the Norwegian Navy. Lt. Omdal has selected a specially qualified crew to keep the plane in condition to operate under the severe weather conditions which they expect to encounter. The "Oriole" has been equipped with snow skids which are interchangeable with the landing wheels and tail skid. Additional gasoline tanks have been installed making the total fuel capacity ninety-four gallons of gasoline, or sufficient fuel at cruising speed to cover a distance of six hundred and forty miles. An aeroplane to operate under the varying weather conditions which will be met on this expedition must be equipped with special devices for regulating the temperature of the motor, of the cooling water and of the lubricating oil, and in this case the Curtiss company have gone a step further and equipped this plane with a Reed duralumin propeller to withstand varying temperatures and moisture conditions and in case of a bad landing it may be possible to salvage a propeller of this kind, where with a wooden propeller the crew would be hopelessly stranded. A detailed summary of the "Oriole" is as follows:

Weight of machine empty (with wheels) 1788 lbs. (with skids)	1845 lbs.
Oil, 5 gal.	37 "
Gasoline, 94 gal.	564 "
Water, 6.6 gal.	55 "
Pilot	160 "
Passenger	166 "
Weight with full load	2770 lbs.
Loading: Area	399.7 sq. ft.
Lbs. per sq. ft.	6.93
Lbs. per h.p.	17.29
High Speed	96 m.p.h.
Low Speed	45 m.p.h.

One of the objects in the presentation by the Curtiss Aeroplane and Motor Corporation of this ship to Capt. Amundsen was the desire to learn something of the operation of the C-6 in the "Oriole" under the severe atmospheric conditions which will be encountered in the Arctic, and further desire to have the Reed metal propeller, which was invented by Mr. S. A. Reed, and of which a number have been built under his direction at the Curtiss factory, tried out under the atmospheric conditions which a metal propeller is supposed to be particularly adapted to withstand. Capt. Amundsen is keeping the Curtiss Aeroplane and Motor Corporation fully advised of the operation of this ship and motor, and is planning if possible to return the ship and motor to the Curtis Company at the end of his expedition with a full report of the details of their operation.

DOMESTIC EXPORTS OF AIRCRAFT AND AIRCRAFT ENGINES, FROM THE UNITED STATES, BY COUNTRIES, DURING MARCH 1922.

Countries	Airplanes and Seaplanes Number	Airplanes and Seaplanes Dollars	Other Aircraft Number	Other Aircraft Dollars	Parts of, Except Engines and Tires Pounds	Parts of, Except Engines and Tires Dollars	Internal Combustion Aircraft Engines Number	Internal Combustion Aircraft Engines Dollars
France	—	—	—	—	—	—	22	6,500
England	—	—	—	—	214	70	—	—
Canada—Mar. Prov.	—	—	—	—	—	—	1	17
Quebec & Ont.	—	—	—	—	1,093	2,230	—	—
Prairie Prov.	—	—	—	—	97	57	—	—
Br. Col. & Yukon	—	—	—	—	198	169	—	—
Mexico	23	19,850	—	—	1,137	270	—	—
Argentina	—	—	—	—	112	291	—	—
Straits Settlements	—	—	—	—	444	100	—	—
New Zealand	—	—	—	—	100	43	—	—
Total	23	19,850	—	—	3,395	3,230	23	6,517

The above figures were compiled by the Department of Commerce.

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COMMERCIAL AVIATION DEVELOPMENT IN THE UNITED STATES

By W. KNIGHT, M. E.

IN A SERIES of articles published in the AERIAL AGE of March 20th and 27th, and April 10th and 17th, 1922, I have summarized the developments of commercial aviation in Europe up to the end of 1921 and I have tried to show that, in spite of the fact that some very decided progress has been made in the organization of aerial transports in Europe in the last three years, they are far as yet from being a success, both from the point of view of the public and the investor in aerial securities.

In every country in Europe commercial aviation activities were born under the regime of a paternalistic government protectorate and have been able to survive and to further expand (in spite of the fact that every one of them represents a dead loss of money), due to the substantial subsidies which have been most generously lavished upon them by the various governments. The French government has contributed more than any other government in Europe to the development of both its military and commercial aeronautical activities, and France is today in a position to claim the supremacy of the air in Europe.

After almost three years of operation and expansion of aerial transports in France and elsewhere under these conditions, a point has now been reached when the people in Europe, and especially in France, begin to wonder what is the matter with commercial aviation which after three years of operation under the regime of government subsidies is unable to earn as yet one-quarter of its operating expenses.

Government subsidies and government control offer some advantages but they also offer a good many disadvantages. Government control of business activities and government subsidies intended to make good the losses incurred in the development of a new national industry and in opening up new international commercial lines of communication are very desirable in some cases as an emergency measure, but in the end they are bound to be detrimental to the development of any commercial enterprise on a healthy business basis if the practice of substituting governmental paternalism to unhampered business initiative is not stopped in time.

Government officials in every country, by necessity of their training in the government service whose business is to raise and to spend the money contributed by taxpayers, are not always particularly competent when it comes to the point of making money out of a business controlled by the government. The history of the business adventures of the government of the United States during the war and after the war is a recent instance that we all know of.

The injection of politics, government control and subsidies into any business activity for any extended period of time is bound to destroy business efficiency in the end and this is what both the people and the governments in Europe are beginning to realize, in so far as commercial aeronautical developments are concerned.

In the United States we have not had up to the present time any government intervention under the form of subsidies for establishing aerial commercial lines in this country, in spite of the fact that the Air Mail Service established and run by the Post Office Department of the U. S. Government stands so far as the biggest and the best organized undertaking of commercial aviation in the world. It is most likely that we shall never have any subsidies paid to our aerial transportation company under the same form as they are paid in Europe, except for whatever service they might be able to perform for the government—as, for instance, for transporting mail at a certain rate per ton-mile with a guaranty of a minimum load for each trip.

The idea of paying subsidies to aerial transport companies as an inducement to them for starting and developing commercial aviation in the United States and to reimburse the losses incurred by them in the operation of aerial lines is undemocratic and against the fundamental American business canons. If the people in this country want this kind of service they can have it, but it is up to them to organize aerial transport companies and to run them as any other business activity with as little interference on the part of the government as is possible and desirable in an undertaking of this nature, which is bound to have a tremendously important bearing on our national defence and on the development of our foreign trade.

Due to the lack of government subsidies and to the fact that right after the war the aircraft manufacturing industry both in this country and abroad had not developed as yet a type of motor and airplane well adapted to commercial exploitation, our business men have been slow in starting any commercial aviation activities in this country. During the last two years, however, some very decided progress has been made by the aircraft manufacturing industry both in Europe and in the United States. Better motors and better airplanes have made their appearance. Metallic airplanes (which are the logical aerial carriers of the future) have been developed, and the airplane has ceased to be a war engine and is now well on the road to become a means of transportation as safe, practical and economical, under reasonable limitations, as any other,—and a good deal more rapid and flexible than any other present means of transportation.

During the last two years, however, in spite of the lack of government subsidies and in spite of the lack of regularly operating aerial lines and of clearly defined national policy and program in aeronautics in this country, almost 31,000,000 miles were flown by both military and civilian aircraft, and 500,000 passengers were carried by civilian airplanes, in addition to many tons of freight.

The failure of Congress to enact a much needed aerial legislation making possible easier credits and more satisfactory insurance rates has been greatly responsible for retarding so far the establishment of regular commercial aerial lines in the United States, which is better adapted than any other country in Europe (with the exception of Russia, possibly) to this new means of transportation of freight and passengers. The action of some incompetent self-styled business men, with no knowledge at all of commercial aviation problems, in starting an aerial transport corporation with great plans for tieing together all the most important commercial centers in the United States and finally failing in the most inglorious way for lack of elementary business sense and common honesty, has also contributed in discouraging people here from investing their money in aerial securities.

The failure of aircraft manufacturers, who are more interested than anybody else in the establishment and development of aerial transportation companies in America, in taking the initiative in opening up and keeping in operation one or two regular aeral lines, just as aircraft manufacturers in Europe did right after the war and are still doing at the present time, has not contributed a bit in inspiring confidence in the public in a means of transportation in which apparently aircraft manufacturers had not enough confidence to invest their money in, all the time, however, keeping the prices of their products sufficiently high to pay for the expense of their partially inactive manufacturing establishments and putting up a lively fight for preventing the dumping into this country of cheaper foreign aircrafts.

The lack of proper financial support that our Aero-Club, the Aeronautical Chamber of Commerce and similar organizations are receiving from the public, the government and aircraft manufacturers is another contributing cause of our slow progress in commercial aviation developments. This, in spite of the fact that both the Aero-Club and the Aeronautical Chamber of Commerce are two organizations which by working together harmoniously and intelligently can render valuable service to our aircraft manufacturing industry and can greatly contribute in eliciting the interest of the public both in this country and abroad in our aeronautical activities. This fact is well recognized in France, where the Aero-Club is one of the best organized in Europe, is a force to be reckoned with in any aeronautical event taking place on the European continent, and is doing a splendid work for contributing to the development of commercial aviation in the world and for protecting and advertising all over the world French aeronautical interests.

In spite, however, of all limitations and handicaps; in spite of the lack of a much needed legislation on aeronautics; in spite of crooks who have tried to use aeronautics as a swindling proposition; the advent of commercial aviation in the United States is coming, is coming fast and once we get started there will be nothing to stop us, and inside of a few years we shall probably lead the world in commercial aviation developments.

We are far behind Europe at the present time because we did not believe, and we do not believe, in government subsidies and government control of aerial operating companies. We do believe, however, that the government, in cooperation with business and technical men and organizations interested in aeronautics, must provide us with aeronautical laws and regula-

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tions, landing fields, meteorological and wireless services, just as European governments are doing. We believe that the government must protect and encourage by any means the development of our aircraft manufacturing industry but, at the same time, aerial operating companies, if they are not expected to operate aerial lines at a loss, especially during the first year or two of operation, cannot be required to buy aircrafts in America if American aircraft manufacturers cannot supply as good aeroplanes as are obtainable in Europe, at such a price as to make it possible for the operating companies to consider the patriotic end of the transaction when they must decide whether to buy their equipment in the United States or in Europe.

To be patriotic about the development of a national aircraft manufacturing industry is all right, of course, but aircraft manufacturers in this country, who have made very substantial profits during the war, must keep in mind that patriotic considerations and business considerations cannot always prevail at the same time unless they are well balanced together. We shall be able to buy good commercial aircrafts in the United States for operating our aerial lines, and we shall be able to afford paying more for them than we would pay for equally good aircrafts made in Europe, provided, however, that our aircraft manufacturers are prepared to buy stock in the operating companies and to share with them the risks and the benefits of the operation of our commercial lines during the first years of operation, if it is so desired. If not, I do not see why our aerial operating companies should not go and buy their flying equipment in England, France, Germany or Italy, wherever they can secure the best terms, unless our aircraft manufacturers can meet the competition of foreign manufacturers in the matter of prices and quality, which they cannot do.

We did not want commercial aviation to be born in this country under the regime of government subsidies and government control because the experience that we have had with such things since the late war has brought us to the conclusion that what we want is: more businesslike methods in our government and less (a good deal less) government control over our business enterprises. However, what we want now is that a real constructive work be started without any further delay for putting on the map of the world commercial aviation in the United tSates, and we want everybody directly interested in this matter to take a share of the responsibilities involved in such an undertaking.

Let Congress take its own share of responsibility and act on the Wadsworth Bill "to create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes," and on other legislation as affecting civil aviation which has now been under consideration by Congress for quite a long time.

Let the financial groups interested in the development of civil aviation in the United States take a hand in seeing that the proper legislation is suggested to and is enacted by Congress at the earliest possible date. Financiers interested in civil aviation developments should also try to discourage at the present time the establishment of a number of small aerial companies. It is much preferable at the present stage of the game to concentrate all efforts into trying to build up and to gradually expand one financially strong company, rather than financing with small means a dozen companies. We must keep in mind that the progress of civil aviation at the beginning is to be obtained through cooperation and not through competition, and that the large overhead expenses of small European companies are largely responsible for the deficit of their budgets.

Promoters of aerial companies must remember that the troubles of European companies in Europe are due to three main reasons: First, aeroplanes not well adapted to commercial exploitation; second, imperfect organization of ground services; and third, insufficient commercial loads. Commercial aeroplanes which it is anticipated will be scrapped after 1000 hours' flight or less and motors requiring overhauling after 100 to 200 hours of operation are too heavy a burden on the operating expenses. An imperfect ground organization is responsible for most of the accidents taking place, is responsible to a large extent for the prevailing high insurance rates, and adds considerably to the operating expenses. Aeroplanes traveling always half loaded are not a paying proposition.

The trouble with the aerial lines in Europe so far has been that they have relied too much on the transportation of passengers and that they have not gone strongly enough after the merchandise transportation business. We should start with mail, express matter and freight. After we have succeeded in convincing people that aeroplanes can be operated safely and regularly on scheduled time all year around, when the farmers in the fields shall regulate their watches every day when the 12:15 or the 2:45 aerial express flies above, then we shall know that we can rely on having all the passengers that we want.

The air line between New York and Chicago most likely shall be the first trunk line to be open to traffic, and the operation of this line will spell the success or the postponement of commercial aviation developments in this country. However, we must keep in mind that one trunk line only, even if that be the New York-Chicago, connecting two of the most important commercial centers in the country, cannot attract at the beginning enough traffic to pay for further expansions and that, rather than encouraging the establishment of other companies for operating other trunk lines in connection with the New York-Chicago, we shall have to try to build up and to gradually expand our activities around one main company and make it a strong foundation of our future civil aviation developments thus keeping down overhead expenses and securing a much needed singleness of policy.

Aircraft manufacturers, as I said before, must be prepared to take quite an active interest in the establishment and the development of aerial operating companies and must not look forward to immediate profits while doing business with new operating companies; on the contrary, they must be prepared to help them along with good flying equipment, low prices and long credits if they are interested in getting the business and in defeating the competition of foreign aircraft manufacturers. Commercial aviation is not going to be a booming business for aircraft manufacturers for the first year or two, and they must be prepared to take their share of responsibility in such an undertaking, from which they are bound to gather handsome profits after the aerial operating companies have been successful in operating aeroplanes manufactured by them.

From the Aeronautical Chamber of Commerce, the Aero-Club and all other similar organizations created for the purpose of encouraging the development of commercial aviation in this country and in the world, I think that it is fair to expect fewer programs of future activities and more reports of results obtained. As I mentioned before, however, these organizatioos cannot be expected to operate without sufficient financial means at their disposal and this financial support must be supplied by the government (city, state and federal), by aircraft manufacturers, aerial operating companies, commercial and financial groups interested in civil aviation developments.

The Aeronautical Chamber of Commerce and the Aero-Club can contribute to the development of commercial aviation in this country and to the expansion of our activities abroad more than any other organization, if we allow them to become the national and international organs of propaganda of our aeronautical activities and the official sponsors of inter-state and national legislation needed in this country for regulating the traffic in the air, and for securing the cooperation of districts and localities in providing properly equipped air harbors and intermediary air lanes under unified federal control.

The extension of the activities abroad of both the Aeronautical Chamber of Commerce and the Aero-Club, in establishing and maintaining a cordial exchange of information and data on commercial aviation developments between aeronautical interests in this country and in Europe and in establishing an effective cooperation between ourselves and Europe in the solution of the international problems which we are bound to face as we develop our activities in the air, is another valuable service which these two organizations can render us.

Three years ago I suggested the extension abroad of the activities of the National Advisory Committee for Aeronautics, for the purpose of establishing an exchange of information and technical data on aeronautics and sciences thereto allied between the U. S. government, on the one hand, and government organizations, technical men, and private concerns in Europe on the other hand. I made this suggestion for the purpose of preserving and further developing the fine spirit of cooperation in the solution of technical problems in aeronautics which prevailed among the allied and associate nations during the war and which was going to be discontinued at the end of the war. My suggestion was taken up by the National Advisory Committee for Aeronautics and I had a chance to realize my project of intellectual international cooperation between ourselves and European government officials of former allied, associated, and former enemy nations, and scientists and technical men in the United States and in Europe interested in technical aeronautical developments. I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics, and from May, 1919, to May, 1921, while acting in the above named capacity, I had the opportunity of creating an effective liaison service between our National Advisory Committee for Aeronautics and technical aeronautical organizations in England, France, Italy, Belgium, Germany, Austria and Holland, whereby our government has been kept fully informed of any progress made in aeronautics as a science and as a branch of engineering. The main and, in my estimation, the most important contribution which has been made by the National Advisory Committee for Aeronautics to the development of aeronautics through the establishment of an office in Europe, has been the promoting of a fine spirit of cordial cooperation between scientists and

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technical men interested in scientific and technical research work in aeronautics.

This fine spirit of coöperation which can be brought about only through personal contact and which can be based only on the reciprocity of advantages to be derived from the exchange of most confidential data and information and the interchange of views on the various aspects of problems under consideration, is a very desirable spirit which, by every means, must be promoted and developed between manufacturing, commercial and financial aeronautical interests in this country and in Europe. In other words, the same exchange of information, the same direct contact which has been established and developed by the National Advisory Committee for Aeronautics and scientists and technical men in Europe, should be established and developed between aircraft manufacturers, aerial operating companies and financial groups interested in commercial aviation developments, both in this country and in Europe.

This work cannot be undertaken by the government through the accredited diplomatic or consular channels. Aeronautical attachés, commercial attachés, consular agents and other government officials in foreign service are necessarily limited in their actions, which must be governed by general rules and regulations in order to prevent interferance between the various agencies of the government working on the same job; and such rules and regulations as are inspired by general governmental policies are not and cannot always be efficient from a limited and well-defined business point of view and in some cases they work exactly the opposite way.

For instance, my personal experience during the two years that I was the representative in Europe of the National Advisory Committee for Aeronautics was that while I was trying to establish a personal and direct contact between individuals and organizations in Europe and in the United States interested in aeronautical developments (which is the only way to exchange valuable information) I was always interfering with the work of naval and military aeronautical attachés who were trying to obtain information on the same subject through regular diplomatic channels. It is quite obvious that individual and private concerns which are ready to cooperate with other individuals and private concerns in a foreign country, with a view of eventually developing their cooperation into a tangible form of business cooperation, do not care a snap about an impersonal inter-governmental exchange of data and information. Considering the fact that I was obtaining most satisfactory results along the line of cooperation which I had suggested, and that I was securing for the National Advisory Committee for Aeronautics through the establishment of personal contacts more complete data and information than it was possible to obtain through other channels, from a point of view of business efficiency, such a work should have been encouraged and further developed. However, the Committee being as it is a governmental organization, the work of its European office had to be brought in line with the work of other similar agencies of the U. S. government foreign service. This was the only proper thing to do and although I knew that such a step would curtail the efficiency of my office I suggested that the Paris office of the National Advisory Committee for Aeronautics be put under the direct control of the various embassies in Europe, which was eventually done.

I said before that what we need at the present time is more business in the government and less government in our business. This is true of aeronautics as well as of any other branch of activity and applies both to this country and to other countries. In so far as our contacts with aeronautical developments in Europe are concerned, it seems to me that it would be to the advantage of everybody concerned if direct contacts were established on a basis of mutual cooperation in exchanging data and information between aeronautical interests in this country and in Europe, without relying on government organizations to do it for us. Of course, so far, we have not had any commercial aerial operating company in this country, and all it was possible to do was what the government has done for collecting statistical and other data about commercial aviation developments in Europe, which will be of great assistance to us in avoiding making the same errors that were made in Europe during the last three years. Considering, however, that we are on the eve of important developments in civil aviation in the United States, it seems to me that we should take into proper account, right at the beginning, the international aspect of this new means of transportation, and this is bound to have quite a tremendous bearing on its development.

The international aspect of aviation is so wrapped up with its national aspect in Europe that from every quarter, even from those more inclined to follow a strictly national aeronautical policy, the need of agreements and cooperation with foreign operating companies is freely advocated in the aeronautical press by aeronautical interests. The necessity of freeing commercial aviation from the bonds imposed upon it by political considerations under the prevailing regime of government tutelage, brought about by the unbusinesslike method of paying subsidies to operating companies to make up for the losses incurred in the operation of aerial lines, is felt every day more keenly and the necessity of establishing direct contacts with foreign aerial operating companies becomes every day more evident from the point of view of business efficiency.

At the present time we are not much concerned with international civil aviation, as we have enough problems of our own to solve in order to put American aviation on the map of the United States. But on the other hand we all realize that inside of a very few years the Atlantic and Pacific oceans will be crossed quite regularly by airships as well as by steamships, and that in a much nearer future we will fly every day to Canada, Mexico, Cuba and South America. And even at the present time when direct shipments can be made right through from Moscow to Havre, or even to Casablanca, I do not see why we should not make arrangements with European aerial operating companies and steamship companies which will allow the making of direct shipments from Moscow to Chicago or San Francisco.

A number of problems are connected with the international side of commercial aviation which are purely business points, and they must be handled through business channels. Close contacts between American and European aeronautical interests in a spirit of mutual cooperation in the solution of common problems is what we need to inaugurate right at the outset of our aeronautical activities in the United States. For this reason we must anticipate the organization of an international association of aerial transportation companies and an international aeronautical Chamber of Commerce, the first one grouping together the most important aerial transportation companies in Europe and in America and the second one coordinating the work of the various aeronautical Chambers of Commerce, aero clubs and similar organizations throughout the world.

The International Air Traffic Association (I. A. T. A.), organized in 1919 by M. Holt Thomas of the "Airco," would admirably serve the purpose for which it was created (which is somewhat similar to the one that we are advocating) if the most important aerial operating companies in Europe had taken an active interest in such an organization. As it is at present, the I. A. T. A. is only an international organism possessing great potential possibilities of an effective cooperation between aerial operating companies which, however, are not sufficiently made use of or sufficiently extended as they should be. In order to obtain an immediate constructive participation of the most important aerial companies in the membership of the I. A. T. A. or of any other similar international association of business concerns in matters of common interest, I think that it would be a good plan to start a move whereby an exchange of capital stock between these companies might take place. If each of the most important aerial operating companies should become a minority stockholder in all equally important foreign aerial operating companies, cooperation between them and a common participation in the solution of international commercial problems would become part of a policy based on limited partnership with each other, this being something which is understood by every business concern and a good deal more efficient than the more or less sentimental general resolutions which are usually adopted at the end of each international aeronautical Congress, without being followed by any immediate practical results. Business concerns are not inclined to waste time and money in international debating associations. They are accustomed to dealing with balance sheets and cold facts. The best ties to unite the most important aerial operating companies in the world are those which are established at the meetings of the board of directors of each of them, where the other companies are represented as minority stockholders.

For the same reasons, the best cooperation between operating companies and aircraft manufacturers is obtained by having the leading aircraft manufacturers in each country become minority stockholders in national aerial operating companies. In this way, the cooperation between operating and maufacturing interests in each country is based on a business partnership between operating companies and manufacturers, the operating companies, however, always reserving the control of the transportation business. In the same way, while the international cooperation between operating companies, under such a plan, would be based on the same principle of partnership with foreign operating companies, each company would always have to retain control of its business.

The international association of aerial transportation companies mentioned above should simply be the organ of coordination of the interests of the various companies in its membership and to that body would be assigned the work of making investigations, preparing reports and suggesting actions and agreements in the interest of the various companies, besides being the official international organ sanctioning any agreement between its member companies.

The International Aeronautical Chamber of Commerce, it was suggested by Mr. E. Pierrot in France, could be con-

(*Continued on page* 311)

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AIR MAIL SERVICE SCHEDULE

C. F. EGGE, general superintendent of the Air Mail Service, has just issued a memorandum showing the mileage between all air mail stations, the maximum number of pounds which may be transported, the origin and kind of mail carried, and the time advanced over rail dispatch.

If the maximum amount of mail is available at each station, the Air Mail advances the delivery of 6,250 pounds or, at forty letters per pound, a total of 250,000 letters daily.

Since July 1, 1921, the percentage of performance has been better than ninety-four, which means that out of each hundred trips scheduled ninety-four were completed.

Air Mail Service Schedule

New York to San Francisco
(Daily except Sundays and Holidays)
Effective May 15, 1922

WEST

Miles

Leave New York 6:00 a. m.,
Arrive Bellefonte 8:55 a. m..... 225
Leave Bellefonte 9:15 a. m.,
Arrive Cleveland by 12 noon.... 210

500 pounds. All letter mail for Cleveland accumulated in New York Postal zone after 8:40 p. m., leaving time of New York and Chicago R. P. O. Train 35. Letter mail for Bellefonte accumulated after midnight. Balance load will be Chicago gateway mail held off New York and Chicago R. P. O. Train 9 due to leave New York 5:15 a. m. (due arrive Cleveland 10:50 p. m) for dispatch to New York and Chicago R. P. O. Train 35 due Cleveland 12:35 p. m. At Bellefonte take on pouch for Cleveland to contain mail for that office and connections. (All Cleveland mail advanced one business day. Air mail arrives before noon; by rail would arrive 5:30 p. m. Train 9 due Chicago 8:00, therefore Chicago gateway mail delivered twenty hours earlier than by rail.)

Miles

Leave Cleveland 8:40 a. m. (E. T.),
Arrive Bryan 9:40 a. m. (C. T.) 160
Leave Bryan 10:00 a. m.,
Arrive Chicago by 12:15 p. m... 175

500 pounds. Take Chicago city mail off New York and Chicago R. P. O. Train 19 due to arrive Cleveland 8:00 a. m. Cleveland office will dispatch pouch for Chicago and Bryan. Bryan will dispatch to Chicago. (Chicago mail advanced one business day in delivery. Train 19 due to arrive Chicago too late for delivery by carrier that day. Chicago mail received at Cleveland has been worked for carrier and station distribution by railway postal clerks in Train 19 between New York and Cleveland. One day service between New York and Chicago. Mail leaving New York 5:30 p. m. delivered by carriers following day in Chicago.)

Miles

Leave Chicago 6:00 a. m.,
Arrive Iowa City 8:00 a. m...... 195
Leave Iowa City 8:20 a. m.,
Arrive Omaha by 11:30 a. m.... 230

500 pounds. 250 pounds Omaha city and balance California and western mail to connect Omaha and Ogden R. P. O. Train 5 at North Platte. (Omaha city mail worked in terminal R. P. O. in Chicago for carrier and station distribution. Delivery advanced one business day.)

Miles

Leave Omaha 1:00 p. m.,
Arrive North Platte 4:15 p. m. (C. T. 245

(Do not hold later than 1:30 p. m. for ship from Chicago, or Omaha train connections.)

500 pounds. Take western mail from Chicago ship, one pouch each for North Platte and Train 5 from Omaha and 300 pounds western mail from C. B. & K. C. Train 27, Minneapolis & Sioux City Train 11-9 and Aberdeen & Sioux City Train 4-104 received at Omaha from Huron & Omaha C. P. Train 209 for dispatch to Train 5 due to leave North Platte 4:32 p. m. (Train 5 is exclusive mail train on fast schedule. All mail handled Omaha to North Platte by air advanced one business day.)

Miles

Leave North Platte 7:30 a. m. (M. T.),
Arrive Cheyenne 10:15 a. m..... 215
Leave Cheyenne 10:35 a. m.,
Arrive Rawlins 12:30 p. m...... 134
Leave Rawlins 12:50 p. m.,
Arrive Rock Springs by 2:15 p.m. 106

500 pounds. Take mail for Cheyenne, Rawlins, Rock Springs, Billings & Denver Trains 31 and 32 via Cheyenne, and Omaha & Ogden Train 3 via Cheyenne, from Omaha & Ogden R. P. O. Train 13 due to arrive North Platte 7:10 a. m. At Cheyenne take on all mail available, which includes Cheyenne pouch for Rock Springs and pouches for Rawlins and Rock Springs from Train 13 received via plane from North Platte. (Train 13 due arrive Cheyenne 3:10 p. m., Rawlins 8:10 p. m. and Rock Springs 12:11 a. m. All mail flown from North Platte advanced one business day.)

Miles

Leave Rock Springs 6:30 a. m.,
Arrive Salt Lake by 8:15 a. m. (M. T.) 155

400 pounds. Take Salt Lake City letter mail off Omaha & Ogden R. P. O. Train 5 due arrive Rock Springs 4:36 a. m. (Delivery advanced Salt Lake City one business day. Train 5 arrives Salt Lake too late for delivery by carrier that day. Salt Lake City mail received from Train 5 has been worked for carrier and station distribution by postal clerks in Train 5.)

Miles

Leave Salt Lake City 6:30 a.m. (W.T.)
Arrive Elko 8:45 a. m.......... 205
Leave Elko 9:00 a. m.,
Arrive Reno 12 noon............ 235
Leave Reno 12:15 p. m.,
Arrive San Francisco by 2:15 p. m. 190

400 pounds. Take letter mail for Elko, Reno and San Francisco accumulated at Ogden and Salt Lake after departure of Ogden & San Francisco R. P. O. Train 9, leaving 12:55 p. m. Elko will dispatch pouches for Reno and San Francisco. Reno will pouch on San Francisco. (Mail delivered in San Francisco eighteen hours and fifteen minutes earlier than arrival by rail.)

EAST

Miles

Leave San Francisco 2:30 p.m. (W.T.)
Arrive Reno by 4:30 p. m....... 190

400 pounds. Take all eastern mail accumulated at San Francisco after departure of Ogden & San Francisco Train 2, due to leave San Francisco 11:00 a. m.; also pouch for Reno. Dispatch eastern mail to Train 2, which is due to depart Reno 9:30 p. m. (Mail for Chicago and east advanced one business day by overtaking fast Train 2 at Reno.)

Miles

Leave Reno 6:30 a. m. (W. T.),
Arrive Elko 9:00 a. m......... 235
Leave Elko 9:15 a. m.,
Arrive Salt Lake by 11:30 a. m., (M. T.) 205

400 pounds. Take eastern mail off Ogden & San Francisco Train 20, due to arrive Reno at 4:35 a. m., and dispatch to Omaha & Ogden Train 2, due to leave Salt Lake 12:00 noon. San Francisco dispatch pouch for Salt Lake via Train 20. Reno pouch on Elko and Salt Lake; Elko pouch on Salt Lake. (Train 20 leaves San Francisco 6:00 p. m. and this dispatch connects at Ogden with Train 2, which left San Francisco at 1:00 a. m. previous day. Advance eastern mail one business day.)

Miles

Leave Salt Lake 6:45 a. m. (M. T.),
Arrive Rock Springs 8:35 a. m.. 155
Leave Rock Springs 8:55 a. m.,
Arrive Cheyenne by 11:00 a. m.. 240

400 pounds. 150 pounds Salt Lake post office and 250 pounds from S. L. C. & Cal. R. P. O. Train 4, due to arrive 6:00 a. m. Salt Lake office and clerks in Train 4 to pouch on Cheyenne office and on Omaha & Ogden R. P. O. Train 20, due to leave Cheyenne 12:40 p. m. Rock Springs pouch on Cheyenne. (Train 20 leaves Salt Lake at 7:50 p. m. By overtaking this train at Cheyenne eastern mail is advanced one business day.)

Miles

Leave Cheyenne 6:00 a. m. (M. T.),
Arrive North Platte 8:00 a. m. (M. T.) 215
Leave North Platte 9:20 a. m. (C. T.),
Arrive Omaha by noon......... 245

500 pounds. Take Omaha city mail off Omaha & Ogden Train 6, due to arrive Cheyenne 1:30 a. m. (arrive Omaha 4:50 p. m.), and from Omaha & Ogden Train 2, due Cheyenne 5:25 a. m. (due Omaha 7:15 p. m.). Cheyenne to pouch on Omaha and Chicago & Council Bluffs Train 8. Train 2 dispatch New York State and New England States for Chicago & Council Bluffs Train 8 connection due to leave U. P. Transfer, Iowa, at 6:30 p. m. At North Platte take on pouch from that office to contain Omaha city and connection. (Omaha mail advanced in delivery one business day. The same is true of all eastern mail carried between Cheyenne and Omaha.)

Miles

Leave Omaha 8:00 a. m.,
Arrive Iowa City 10:30 a. m..... 230
Leave Iowa City 10:50 a. m.,
Arrive Chicago by 1:00 p. m..... 195

500 pounds. Take Chicago city mail from Omaha post office and from Omaha & Ogden Train 4, due 7:00 a. m., and from Omaha & Denver R. P. O. Train 6, due 7:00 a. m., and Omaha & Ogden Train 12, due 7:05 a. m. Omaha post office pouch on Iowa City; Iowa City pouch on Chicago. (Trains from which Chicago mails were taken due to arrive Chicago 8:00 to 10:00 p. m. Chicago mails advanced in delivery one business day.)

Miles

Leave Chicago 1:00 p. m. (C. T.),
Arrive Bryan 3:00 p. m......... 175
Leave Bryan 3:20 p. m.,
Arrive Cleveland by 6:00 p. m. (E. T.) 160

500 pounds. Take New York City mail and mail for points east of Cleveland formerly dispatched to New York and Chicago R. P. O. Train 10 (leaving Chicago 10:30 a. m. and arriving Cleveland 8:30 p. m.) and from Train 26 (leaving Chicago 12:40 p. m. and arriving Cleveland 8:35 p. m.) for dispatch at Cleveland to New York and Chicago R. P. O. Train 4, due to leave

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6:15 p. m. and arrive New York 8:00 a. m. Chicago post office dispatch pouch for Train 4 and for Bryan and Cleveland offices; Bryan to dispatch pouch for Cleveland. (New York City mail dispatched at Cleveland to train arriving in New York in time for bank clearance.)

	Miles
Leave Cleveland 6:00 a. m. (E. T.),	
Arrive Bellefonte 8:30 a. m.....	210
Leave Bellefonte 8:45 a. m.,	
Arrive New York by 11:30 a. m.	225

500 pounds. Take New York City letter mail off Train 22, New York and Chicago R. P. O. (due to leave Chicago 5:30 p. m. and arrive Cleveland at 2:56 a. m.) Cleveland will pouch on New York; Bellefonte will pouch on New York. (Train 22 due to arrive New York 5:25. The New York City mail received from Train 22 at Cleveland is worked for carrier and station distribution by railway postal clerks between Chicago and Cleveland. One day service between Chicago and New York. Mail leaving Chicago at 5:30 p. m. delivered by carriers following day in New York.)

Note: The time shown in this schedule for arrival and departure at intermediate stations and arrival at terminals only for reference. Ships will leave intermediate stations as early as possible after being serviced. The time of departure from initial points will be strictly adhered to and our records of past performance indicate that arriving time at the several terminals will, under ordinary circumstances, be much earlier than that shown on this schedule, which has been made on a 70 to 90 miles an hour basis.

NOTES ON PROPELLER DESIGN—IV

GENERAL PROCEEDING IN DESIGN

Technical Note National Advisory Committee for Aeronautics

By MAX M. MUNK

Summary

THE choice of tne number of revolutions and of the diameter, the distribution of thrust, and the values of the constants in the aerodynamical equations of the propeller are discussed.

The exact design of a propeller must be preceded by approximate computations, leading to the general layout, which in turn must be followed by an analytical examination of the propeller, obtained under several conditions of flight. In the previous notes of this series I have discussed these three steps, including the determination of the distribution of thrust, at length. It will be useful to summarize the procedure briefly in this note and to discuss some general principles in connection with it. For the design of a propeller is a laborious undertaking, and the analysis of the finished design ought to confirm that it is correct. The analysis is not the proper method for studying the effects of different assumptions for the layout. This can be done more shortly and more successfully by a general discussion.

The number of revolutions of the propeller is, in general, determined by the engine; but the prohlem often remains as to whether reduction gearing is advisable. Now the reduction gear always has a friction loss of 2% at least. What is more serious, it requires a great additional weight of the propeller and gear, it gives rise to increased stresses of the fuselage, and it involves additional complications and possibilities of dead stops. It is expensive, too. These disadvantages cannot exactly be taken into numerical consideration. But it can be safely said, I think, that the reduction gear is inadvisable if the aerodynamical efficiency of the propeller is increased less than 5% by its application. There are designers who prefer even an aerodynamic loss of 10% to a reduction of the number of revolutions by gearing.

The question of the diameter and of the number of revolutions is not exclusively a question of efficiency. There are, of course, upper limits for the velocity of the blade tips. Besides, the design of the propeller is carried out, having in view one particular condition of flight, whereas the propeller is to be used under very variable conditions. It is desirable that (a) the efficiency be fairly high under all conditions and that (b) the absorbed horsepower at the same number of revolutions remain nearly constant. Only if these two requirements are fulfilled at the same time, can the propeller develop the highest thrust horsepower. These two requirements lead now to a limitation of the tip velocity of the propeller hlades. For this tip velocity determines the average velocity of the blade elements and hence the variation of their angles of attack. But it is this angle of attack which has to conform to the variation of the thrust, and hence the variation of the angle of attack determines the lift coefficient. A calculation shows that for constant density of the air the best lift coefficient corresponds to the usual tip velocity, high enough for a favorable ratio C_L/C_D. This appears if one applies the aerodynamical equations for the blade element. Hence the designer has to keep in mind that a change in the tip velocity has a noticeable effect either on the behavior of the propeller over a wide range of conditions or on its efficiency, and that this effect cannot be neutralized by minor changes in the design.

The question is intimately connected with that of the advisability of variable pitch. I have just mentioned the fact that for constant density a satisfactory propeller can be designed having constant pitch. Variable pitch is useful only for great altitudes. But then indeed it can greatly improve the performance of the propeller. The variation of the pitch enables the propeller to conform to an additional variation of the conditions, that is, the variation of the density of air.

Some designers of variable pitch propellers claim that the center of pressure of the blade sections of their propellers does not travel. Whether this be true or not, it has nothing to do with the variability of the pitch. For the travel of the center of pressure is due to the change of the lift coefficient of the blade elements, which always takes place for different conditions of flight, because the lift coefficient is nearly proportional to the thrust, and the thrust changes. Hence the center of pressure does not travel if the blade section used is one without travel of center of pressure, whether the pitch be changeable or not.

Proceeding now to the general layout, I have shown that the diameter must satisfy the condition:

$$(1)\qquad D < \sqrt[3]{\frac{T}{nV\frac{\rho}{2}}\, C_L/C_D\, \frac{6}{\pi^2}}$$

where T denotes the thrust,
ρ the density of air,
C_L/C_D the lift/drag ratio of the blade section.

This equation gives too high a value for a small velocity of flight such as occurs during the start, for instance. C_L/C_D can be assumed to be 22. The diameter thus obtained is only a rough indication of the upper limit; the weight, the stresses and the structural point of view are not yet taken into account. In general the diameter is given by other considerations, and the following method is valid for any diameter, however determined.

After having made the decision as to the magnitude of the diameter, the required horsepower is to be estimated and to be compared with the horsepower delivered by the engine. The thrust horsepower may be written $N_o = T\,V$. The sum of the thrust horsepower and slip stream loss is then

$$\frac{N_o\,(1 + \sqrt{1 + C_p})}{2} \quad \text{where } C_p = \frac{}{D^2 \frac{\pi}{4} V^2 \frac{\rho}{2}}$$

The friction loss is $.033\, N_o \frac{\pi Dn}{V}$. Hence the smallest brake horsepower possible is approximately

$$(2)\qquad N_o \left\{\frac{1 + \sqrt{1 + C_p}}{2} + .033\,\frac{nD\pi}{V}\right\}$$

The factor 0.033 refers to average conditions and to a lift coefficient of the blade of about 0.4 to 0.8. For smaller lift coefficients the factor is greater, and for higher it may be smaller, say up to $C_L = 1.2$, and then greater for still higher lift coefficients. This depends on the blade section.

The next step is the determination of the number and breadth of the blades. First, the lift coefficient is to be assumed. The highest lift coefficient occurring ought to be about 0.80 to 1.10. It can be said that the lift coefficient is fairly proportional to the thrust. Its value to be chosen is therefore in the neighborhood of T/T_{max} where T is the thrust for which the propeller is designed and T_{max} the greatest thrust ever occurring for the propeller.

The lift coefficient being chosen, the product of the number of blades and the average breadth of each blade is approximately

$$(3)\qquad i\,t = \frac{6\,T}{C_L \frac{\rho}{2} n^2 D^4 \pi^2}$$

This formula makes it possible to decide on the number of the blades and on their breadth.

The general layout of the propeller is thus finished and the design in detail can begin. First, the distribution of the thrust is to be decided upon. The coefficient of thrust is to be assumed, taking

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(4) $$C_T = 1.1 \frac{T}{q\,D^2 \frac{\pi}{4}}$$

at 2/3 of the radius and

(5) $$C_T = 1.1 \frac{T}{q\,D^2 \frac{\pi}{4}} - \frac{2}{3} V/U\ C_D/C_L \frac{\pi n D}{V}$$

at the tip, where q is the dynamic pressure. For a very low velocity of flight, the last expression can be slightly decreased. This is, however, not yet the definite value of the thrust coefficients at these points. A diagram is to be drawn now, plotting the thrust coefficient against the radius. The two values just calculated are put in and connected by a straight line. Then the two ends of the curve so obtained are rounded off. At the outer end the rounding may begin, say 10% of the radius from the end, and the curve may end elliptically. At the inner end, the thrust coefficient is zero over the hub, and near it, only a small density of thrust can be realized, say

$$\frac{1}{2}\left(\frac{\pi n r}{V}\right)^2$$

or even the same expression with a factor smaller than $\frac{1}{2}$, if there are only two blades and these narrow ones. This gives a limiting curve inside, which is to be rounded off where it intersects the first one.

One must now see whether the curve of thrust coefficient thus obtained gives the desired thrust. The radius is to be divided into a number of equal parts Δr, say 10 parts. For each part the average value of the thrust coefficient is to be taken from the diagram and is to be multiplied by the radius r. All these products are to be added, and the sum A so obtained is to be multiplied by $2\pi\ \Delta r.\ V^2\ \rho/2$, thus giving

(6) $$T_1 = A\ 2\pi\ \Delta r\ V^2 \frac{\rho}{2}$$

This thrust will not agree exactly with the desired thrust T. Therefore all coordinates C_T are to be increased by the constant additional term $(T - T_1)/(.78\ D^2 q)$. Then they represent C_T for each blade element, and the section of each blade element and its inclination can be laid down.

For the choice of the blade sections the same rules are valid as for the choice of wing sections. The angle of attack for the desired lift coefficient can be calculated or it can be taken from a model test. In the last case the induced angle of attack $\frac{C_L}{\pi}\frac{t}{b}$ where b/t is the aspect ratio of the wing model, is to be substracted from the angle obtained during the test. The drag too is to be reduced to a drag for infinite aspect ratio, and an additional constant reduction of the drag coefficient making the minimum drag coefficient 0.02, will improve the result.

HUGHES

Let now δ be the difference of the angle ϵ of inclination of the blade element with respect to the propeller plane and the angle of attack β. This angle δ is to be determined by means of

(7) $$\tan\delta = V/U + \tan\delta\,(1 + V/U)\left\{1 + \frac{2\sin^2\delta}{C_T} - \sqrt{\left(1 + \frac{2\sin^2\delta}{C_T}\right)^2 - 1}\right\}$$

where U denotes $2\pi r n$. This equation is to be used by substituting an approximate value of $\tan\delta = 1.1\ V/U$ in the right-hand term. Sometimes the proceeding is to be repeated by substituting the value of $\tan\delta$ thus obtained. When $\tan\delta$ is found, the angle of inclination is

(8) $$\epsilon = \delta + \beta$$

and the chord of the blade is obtained:

(9) $$t = 4\sin\delta\ \frac{\tan\delta - V/U}{1 + V/U}\ \frac{2\pi r}{i\,C_L}.$$

For the analysis the following equations are used:

(10) $$\tan\delta = \frac{(\tan\epsilon\tan\delta + 1)\quad (1 + V/U)\sin\delta + \frac{4\ r}{i\ t}\ (\tan\epsilon\tan\delta + 1)}{\tan\epsilon\,(1 + V/U)\sin\delta + V/U\,\frac{4\ r}{i\ t}}$$

(11) $C_L = 2\pi(\epsilon - \delta)$. With some sections, C_L is slightly less.

(12) $$m = \frac{i\ t}{2\pi r}\ \frac{(\epsilon - \delta)\ \pi}{2}$$

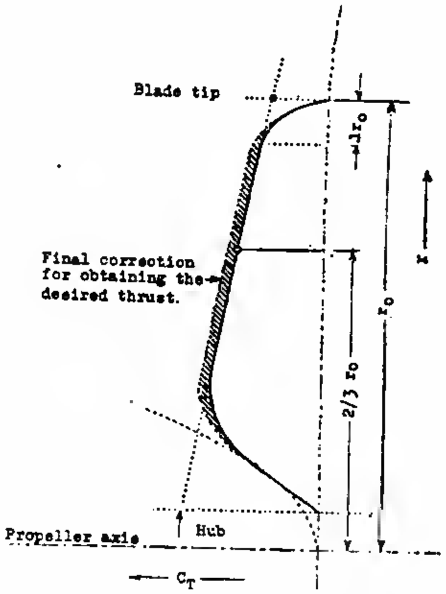
(13) $$C_t = \frac{4\ m\cos\delta}{1 - m\cos\delta/\sin^2\delta}$$

(14) $C_Q = C_T\,(\tan\delta + C_D/C_L)$.

(15) $$T\ \Sigma\ C_T\ 2\pi\ r\ \Delta r\ V^2 \frac{\rho}{2}$$

(16) $$\text{Torque} = \Sigma\ C_Q\ 2\pi\ r^2\ \Delta r\ V^2 \frac{\rho}{2}$$

Equation (10) is to be used instead of equation (7), assuming that $tg\delta$ lies between V/U and $\tan\epsilon$.



Harold J. Powers, Pioneer in Radio Broadcasting

Harold J. Power of Medford Hillside, Massachusetts, according to an article in a recent issue of the National Magazine, deserves credit not usually assigned to him as a pioneer in radio broadcasting. Mr. Power is the first man in America to have established daily broadcasting, according to this article. The radio historians wll have to decide between Mr. Power's station in this matter, and the Pittsburgh station of the Westinghouse Company (K D K A), which claims the same honor. True it is that Mr. Power did more than most men in putting radio transmission on a commercial basis.

Mr. Power was one of those boys who just can't keep their fingers out of father's tool chest, and who are everlastingly tinkering with the telephone, the electric light circuit, or anything about the house that will give the mechanical genius a chance to sprout.

"It was during a grammar lesson that I first became interested in radio," Mr. Power says, "copying the sentence in my copy book which ran 'Marconi, the inventor of the wireless telegraph.'"

The little boy, who was already very much interested in electricity, ran right home and began the business of building his own set. His first one stood on a table made from an old wooden box, and a wire strung from a post attached to the clothes pole in mother's yard constituted the antenna. The first message which he received (from the Boston navy yard) was the occasion in the middle of the night of an unceremonious rousing for all who had the fortune (or misfortune) to belong to the young experimenter's family or neighborhood.

"The story of Mr. Power's success," the writer of the article referred to, concludes, "is another proof that persistence is the forerunner to fame."

Tells How to Work Vacuum Tube Sets

Some good advice to the radio novice on the matter of adjusting and operating a vacuum tube set, always a troublesome matter even though the experimenter has constructed most of the elements himself, is given by Walter Remy in a book, "The Radio Primer," just published by Ralph T. Goodwin.

In explaining how to get results after the set has been correctly constructed and assembled, the writer says:

"After the tube was inserted in the socket the filament rheostat was turned until a slight hiss was heard in the phones. The tickler coil was set at an angle of 45 degrees with respect to the tuning coil and the variometer was rotated. If a click was heard, followed by a sound like that of escaping steam, the set was operating properly. With the receiver in this state the variable condenser was turned until a squeal was heard. This squeal is what is called the carrier wave of the radio telephone.

"The variometer was turned back again until the hiss and the squeal stopped and the variable condenser was moved a fraction of a degree until the radio phone was heard the loudest. The tickler coil was varied until the music or other signals were heard the loudest and the adjustment was left fixed. This adjustment did not have to be made again. The rheostat was varied to determine if any increase in strength of signal could be obtained. This latter adjustment was also permanent."

The new book is unusual in the recent outhurst of radio literature in that it stays close to its subject, which is the construction and operation of a home radiophone, explaining the theory of wireless when necessary through simple analogies.

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WAR DEPARTMENT SELLING PROGRAM

JUNE

June 7—AIR SERVICE SUPPLIES—Morrison, Va., Auction. For catalog write, C. O., Air Service Depot, Morrison, Va.

June 8—Q. M. SUPPLIES—Camp Jackson, S. C., Auction. For catalog write C. O., Q. M., Intermed. Depot, Candler Warehouse, Atlanta, Ga.

June 9 — ORD. MATERIAL — Springfield Armory, Mass., Sealed Bid. For catalog write, Boston Dist. Ord. Salv. Board.

June 14—Q. M. SUPPLIES—Atlanta, Ga., Auction. For catalog, write, C. O., Q. M., Intermediate Depot, Candler Warehouse, Atlanta, Ga.

June 15 — HARNESS — Washington, D. C., Sealed Bid. For catalog, write Col. Warfield, 1222 Munitions Bldg.

June 15—PLANES—ENGINES—Washington, D. C., Sealed Bid. For catalog write, Chief, M. D. & S. Sect., 2624 Munitions Bldg.

June 15—Q. M. SUPPLIES—Chicago, Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, 1819 W. Pershing Rd.

June 16 — CASTOR OIL — Washington, D. C., Sealed Bid. For catalog write, Chief, M. D. & S. Sect., 2624 Munitions Bldg.

June 15 — MOTORS — STEEL — Watertown Arsenal, Watertown, Mass., Sealed Bid. For catalog write, Boston Dist. Ord. Salvage Board.

June 19—Q. M. SUPPLIES—Camp Sherman, O., Auction. For catalog write, Gen. Intermed. Depot, 1819 W. Pershing Rd., Chicago, Ill.

June 22—Q. M. SUPPLIES—Boston, Mass., Auction. For catalog write, C. O. Q. M., Intermed. Depot, Boston.

June 27—Q. M. SUPPLIES—Norfolk, Va., Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.

"Camp Grant Sale, scheduled for June 13, has been postponed to Aug. 3."

JULY

July 6 — Q. M. SUPPLIES — San Antonio, Tex., Auction. Send catalog requests to Q. M. S. O., Ft. Sam Houston, Texas.

July 7—Q. M. SUPPLIES—Washington, D. C., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

July 11—AIR SERVICE SUPPLIES—Buffalo, N. Y., Auction. Send catalog requests to C. O., Curtiss-Elmwood Depot, Buffalo, N. Y.

July 12—Q. M. SUPPLIES—San Francisco, Calif., Auction. Send catalog requests to Q. M. S. O., Gen. Intermed. Depot, Ft. Mason, San Francisco, Calif.

July 13 — Q. M. SUPPLIES — Omaha, Neb., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 18—Q. M. SUPPLIES—Chicago, Ill., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 20—Q. M. SUPPLIES—Columbus, O., Auction. Send catalog requests to Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 25—Q. M. SUPPLIES—New Cumberland, Pa., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

July 25—Q. M. SUPPLIES—Camp Jackson, S. C., Auction. For catalog write, C. O., Q. M., Intermed. Depot, Candler Warehouse, Atlanta, Ga.

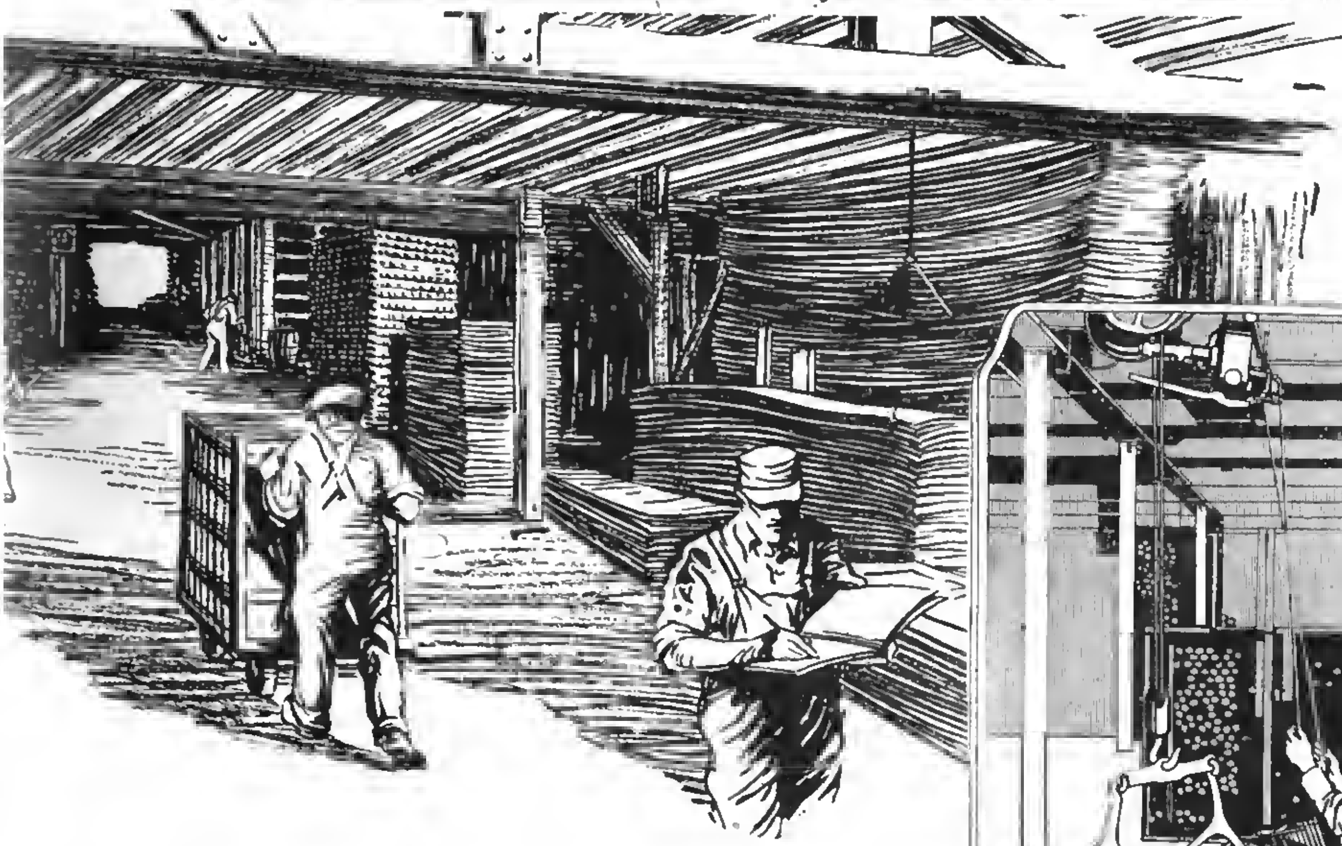
July 28—Q. M. SUPPLIES—Philadelphia, Pa., Auction. Send catalog requests to Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

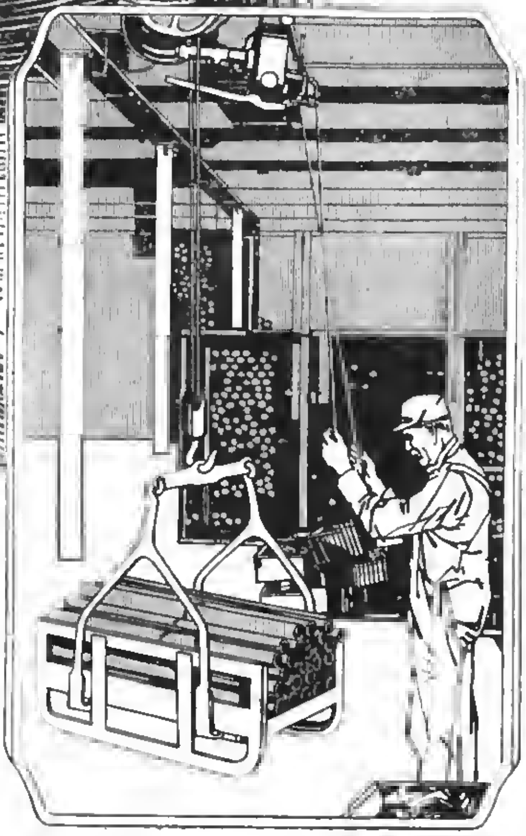
SEND FOR CATALOG **SEND FOR CATALOG**

THE list of sales at the left is an index to offerings of materials you will want to investigate. Detailed advertisements of each sale will appear regularly in this publication and in other representative journals. Follow those advertisements and discover the benefits of the War Department as a source of supply. Check up the advertisements with this list and make sure no offerings are overlooked.

"The Government reserves the right to reject any or all bids."

WAR DEP





From War Department Sales to Your Production Needs

Stored in warehouses, the War Department has vast quantities of raw materials. They were bought to stand up under the exacting usages of war, and they match in quality the materials for which you are competing in the open market. The Government needs the money they represent, and they can be purchased for sums not duplicated elsewhere in value.

Here is a source of supply it will pay your purchasing department to investigate. Sales are conducted virtually every week by auction or sealed bid. Follow the War Department advertisements, write for catalogs of materials you can use, and participate in the sales.

For Catalogs, Proposal Blanks and Full Information regarding all sales, write:

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ARTMENT

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NAVAL and MILITARY AERONAUTICS

Air Service Reserve Activities in Colorado

The headquarters of the 103rd Division, Air Service, was recently established in Rooms 210 and 213, Federal Building, Colorado Springs, Colorado. The office was opened up by borrowing a few small tables and chairs from the custodian of the building, pending the arrival of office equipment on requisition. A great deal of publicity was given concerning the establishment of headquarters by local newspapers, with the result that many inquiries were received from former service men and reserve officers located in and near the city of Colorado Springs. All who made inquiries were interested to know if, in joining the reserves, an opportunity would be afforded them to fly. All were anxious to get hold of the controls again and to keep up their training. The officer on duty with the Division Air Service at once set about to locate a suitable landing. field where he could invite visiting ships to land, the information found in "Notice to Aviators" for January 1, 1922, concerning a field in this locality, not being reliable. An excellent field was located, and permission to use same has been granted by the owner. With the assistance and co-operation of a local flyer, a 40-foot white circle was made in the center of the field, and a standard wind sock placed at one end of a pole. This information, with a sketch of the field, was sent to the Chief of Air Service; Air Officer of the 8th Corps Area; Post Field, Fort Sill, Okla.; and Kelly Field, Texas.

The organization of the 103rd Division, Air Service, as to the assignment of officers is just about complete, there being a few vacancies yet in the grades of Captain and First Lieutenant, and a surplus in the grade of 2nd Lieutenant. Enlistments for the 103rd Division, Air Service, have not as yet been undertaken due to lack of a clerk and office equipment and supplies. Hope is entertained that this deficiency will be supplied in the very near future.

Air Service Detachment Returns from Germany

The Air Service Detachment, consisting of two officers and 83 men, arrived at Mitchell Field on May 4th, from Germany. This detachment was apparently assigned to Mitchell Field to be broken up and the personnel distributed to other Air Service stations. This fact is regretted very much by Mitchell Field, because it is found that the detachment contains some very excellent soldiers and mechanics. The officers reporting with the detachment, 1st Lieutenants Dogan Arthur and Russell M. Greenslade, Air Service, have been ordered to report to Langley Field and Kelly Field, respectively.

316th Reserve Squadron Gets Under Way

After many trials and tribulations the 316th Squadron has finally gotten under way. With the assignment of Captain A. F. Harold to duty as Air Officer for the 91st Division, the final obstacle to actual work was removed. Two Hissos were acquired for the instruction of the pilots and an old DH for the instruction of the enlisted personnel. A staff sergeant and four specialists were detailed to temporary duty with the squadron.

Class instruction takes place every Monday night in the hangar which has been turned over for the exclusive use of the Reservists. On alternate Saturdays and Sundays practical ground instruction and flying takes place. The ground instruction is under Staff Sergeant Fowler (28th Squadron). The Specialists act as instructors in their respective specialties.

There are assigned for duty to the squadron 33 officers, leaving a shortage of only two for the full 100 per cent. Enlistments are being sought, it being the intention to enlist the men in a body when a complement of about 50 per cent of the authorized strength has been acquired. About 25 men are now taking instruction.

The 316th Photo Section has its full officer personnel, and is about ready to enlist its full quota of men.

Reserve officers have flown approximately ten hours during the week of April 25. A shortage of oil compelled the cessation of flying. Lieuts. Farmer, Kearny and Cavagnero have successfully soloed during the week. Hopes are being entertained that all the officers of the organization will take advantage of the opportunity and take a refresher course soon.

Post Field Fliers Visit Muskogee, Okla.

Fourteen ships (DH's) from Post Field, Fort Sill, Okla., paid a visit on Saturday, April 22, to Muskogee, where the Headquarters' 95th Division, Air Service, is located.

Major Thomas G. Lanphier, Officer in Charge of Flying at Post Field, with Captain Alexander Mileau, Flight Surgeon at Post Field, was in charge of the flight. Captains Vernon L. Burge and Frank L. Pritchard were the other officers of the permanent garrison making the flight. The following student officers of the Air Service Observation School, for whom the flight was a practice cross-country flight, were among those present: Captin De Ford, Captain Derby, Lieutenants Shrader, Vidal, Wisehart, Davidson, Stackhouse, Shen (Royal Chinese Navy), Cooper (Chile), Evert, Williamson, Peck, McBlain, Schabacker, and four mechanics.

Captain Charles B. Oldfield, Executive Officer of the 95th Division, Air Service, was on the field to meet the visitors. After all had arrived, Major Lanphier led a five-ship formation over Muskogee, with Captain Oldfield and Lieutenants Vidal, Shrader and Davidson following.

The secretary of the local Chamber of Commerce, Mr. Lydig, was on hand to greet the visiting fliers, as were also newspaper representatives and a number of citizens of Muskogee. Each visitor as he arrived on the field was given a complimentary card by the secretary of the Chamber of Commerce which entitled him to hotel accommodations at one dollar per day, 20 per cent off on all meals and free admission to the ball game.

Flying Activities at Carlstrom Field

The records of the Flying Officer at Carlstrom Field, Arcadia, Fla., show a total of 65 student officers and cadets under primary flying instruction during the month of April. A total of 5 officers and 13 cadets were relieved from further instruction during the month by the Academic Board. The total man hours flown during April was 2,174.55, aircraft hours flown, 1,480:20.

Elimination Contest at Scott Field

In preparation for the National Balloon Race to be held at Milwaukee, Wis., on May 31st, an elimination contest was held on Saturday, May 6th. Two balloons of 19,000 cubic feet capacity were used, the first piloted by Lt. J. W. Shoptaw, Chanute Field, with Lt. Courtland Brown as aid, and the second piloted by Lt. J. H. C. Hill, Scott Field, with Lt. James Healy as aid. Both balloons covered in the neighborhood of 110 miles, but Balloon No. 1, although holding a few miles advantage over Balloon No. 2, was in the air fifteen minutes longer. The race was so close that all data has been sent to the Chief of Air Service for his award.

Major Fitzmaurice Retires from Active Service

Major William J. Fitzmaurice, Air Service, who has been in command of the Montgomery Air Intermediate Depot since October, 1920, has been retired from active duty with the army, and will be succeeded in command by Major Roy S. Brown, commanding officer of the 22nd Squadron.

Major Fitzmaurice began his military career upon entrance to West Point Military Academy in 1904. He graduated therefrom in 1908, and was appointed a 2nd Lieutenant of Infantry. During his 18 years of service he has filled many important positions of responsibility. He saw foreign service in Alaska, Panama, France and Germany. It was while on duty in Germany that he met with a most severe and painful accident, which caused his physical disability and consequent retirement. A rifle he was using exploded, and particles of steel entered his right eye.

The last official ceremony, in which Major Fitzmaurice received the officers and troops in his command, was held on the morning of May 2nd. He addressed the men, expressing his satisfaction and appreciation of the cooperation from officers and men that has made the 22nd Squadron and the 4th Photo Section successful. He expressed regret at leaving the military service and in parting with the personnel of the depot and his many friends in Montgomery.

Major Fitzmaurice intends to make his home in Los Angeles, Calif., where his parents now reside.

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FOREIGN NEWS

Aerial Map of Capetown

Taken after much patient manoeuvring by aeroplane, an aerial plan of Capetown's business centre has been photographed and issued for the guidance of all concerned, reports the *Cape Argus*. This novel guide is a reproduction of composite photographs of central Capetown, the leading buildings being neatly labelled. The result is a startlingly graphic map, which is unique, so far as South Africa is concerned. A key of the plan indicates more clearly the exact position of any given building, to which a number is assigned. Guided by the number in its sequence, the person interested can follow up his investigations at the foot of the plan. The map is published by Mr. Ken Donaldson.

The French Engine Competition

The regulations for the French contest for aero engines which is to be held during 1924 have just been issued.

This contest, which is due to the initiative of the Comité Francaise de Propagande Aeronautique, is supported by the Under Secretary of State for Aeronautics. The Committee and the French Air Ministry have each assigned a sum of one million francs for the purpose of the competition.

The million allocated by the Government is to provide two prizes each of 300,000 francs for engines of French origin, and the million allocated by the Committee is to be devoted to purchasing for the benefit of the French Government the French manufacturing rights in the engine which is adjudged to be the best. Engines of any origin—except those from ex-enemy countries—are eligible for the competition, but not for the two prizes above mentioned as reserved for French engines.

In the event of the winning engine being of foreign origin, in addition to the sum of one million francs, provision is made for the payment of royalties at a maximum rate of 8,000 francs per engine for the first 100 engines built, decreasing 1,000 francs at each 100 engines till the 600th, whereafter a uniform maximum royalty of 2,000 francs per engine is payable.

Entries will be received up to December 1, 1922, by the Commission d'Aviation of the Aero Club of France if accompanied by an entrance fee of 20,000 francs. Entries will be received up to December 1, 1923, at an entrance fee of 40,000 francs. Foreign competitors will in addition be required to contribute 10,000 francs toward the cost of testing.

Half of the entrance fees will be returned to all competitors who pass the eliminating tests. The special contribution of 10,000 francs from foreign competitors will be returned to those who may withdraw before the official opening of the trials.

Engines must be of the internal combustion type, and of a normal output of between 350 and 450 h.p. The weight per h.p., including the weight of fuel and oil for 5 hours, must not exceed 3.3 kg. per h.p. The speed of rotation of the airscrew is not to exceed $\frac{32,000}{\text{V.H.P.}}$ r.p.m.

All engines are to be fitted with a self-starter such that the engine may be started at a distance without turning the engine by hand. This starter alone is to be used for starting during the whole of the trials.

Engines will be required to undergo eliminating trials, including five hours' run on an air brake on the test bed, and two hours' flight on an aeroplane which is to be provided by the entrants.

Thereafter the engines will be submitted to an endurance test totaling 240 hours' run in thirty periods of 8 hours each on the test bench. The load is to be an air brake of the airscrew type, supplied by the competitor, and the engine will be mounted on a pivoted test bed, which will allow measurement of the brake h.p.

The total of 240 hours' run is required to be made in not more than 100 days—not more than one run per day—and penalty marks will be awarded for every delay in starting, for every stoppage during a run, for every day taken to complete the tests in excess of the possible minimum of 30 days, and for every repair and replacement made during the whole period. Any individual run may be annulled on account of delays in starting, stoppages, or failure to develop the required power.

The whole endurance test may be annulled if more than 10 such runs have been annulled, if more than 30 days elapse between any two consecutive 8-hour runs, or if the total of repairs or replacements exceed certain specified limits.

A second attempt may be made, but is to be completed in 80 instead of 100 days. Such a second attempt is attended by penalty marks.

Marks are to be awarded for the weight per h.p., with five hours' fuel and oil, as determined from the actual consumption and power developed during the trials. If the weight per h.p. so computed is more than three k.g. per h.p. the marks are penalties; if less, they are set against penalties.

Penalties are inflicted for the air resistance of the engine, which is taken as proportional to the area inside the smallest convex contour which will entirely enclose the projection of the motor on a plane normal to the airscrew axis. This area, divided by the normal full power of the engine, is the basis of the penalty marks.

The sum of all penalties, less any good marks for low weight per h.p., will serve to classify the competitors, the lowest total being that of the winner. One of the 300,000-franc prizes for French engines will be awarded on this same basis. The second 300,000-franc prize will go to the French engine which gives the best results on the two points of weight per h.p. and head resistance.

Complete details of the rules, conditions of entry, and so forth, may be obtained on application to the Commission d'Aviation de l'Aero Club de France, 35, Rue Francois 1er, Paris.

The system of penalty marking laid down in the regulations for this competition has certain very interesting and somewhat ingenious features. The system has obviously been devised with the intention of eliminating so far as is possible the effects of accidental ill-chance on the prospects of a good engine, and of penalizing very severely any form of consistent ill-behavior.

Penalties are imposed for all delays in starting, and for stops during test runs. These penalties vary with the time of delay or stop. If the delay does not exceed one hour, if there is not more than one stop in a run, and that stop is of less than one hour, the penalty on the score of stop or delay goes no further. But if either stop or delay exceed one hour, or if there is more than one stop, the run is annulled. There is a penalty for annulment, and in addition a further penalty for the extra day taken to complete the 240 hours' total.

And if the stop or delay involves the repair or replacement of any part there is a penalty for that repair or replacement. This penalty is inflicted for repairs, etc., even if it does not lead to delay or stoppage. The penalties are thus cumulative, and increase as their effects become more serious.

But the method of penalizing for repair and replacements is extremely ingenious. There is a basic scale for these, the penalties increasing with the time needed to carry out the work, whether the work is of a nature which allows immediate resumption of the test, or necessitates "tuning up" and preliminary running before continuance of the tests. Also generally the penalties for the replacement or repair of an isolated piece are less than are those for a complete unit. That is, it is cheaper to replace a big-end bush than a complete connecting rod unit, and it is cheaper to replace an accessory unit such as a magneto than an essential of the engine, such as a complete cylinder. This is quite apart from penalties which arise from the delay in carrying out the change.

But the basic scale applies only to the first time of repairing or changing a given unit or type of unit. Wherever a part has already been changed or repaired the penalty for change or repair to a similar part (not necessarily the same part) is to be that in the scale, multiplied by the total number of changes or repairs to the same part or type of part. From this rule plugs and valves are excepted. In their case the penalty is imposed plus the number of preceding replacements.

The effect of this rule is that the tenth defective water or oil joint to be replaced during the tests will involve a direct penalty as great as that due to the changing of a crankshaft or cylinder. Thus silly little failures due to faulty design or workmanship which recur continually are very heavily penalized, while a more serious breakage which may be due to an undiscoverable flaw or to some accidental mischance does not necessarily put an engine out of the contest.

Aerial Transportation in Europe

Consul Dreyfus, Dresden, reports to the Department of Commerce that on April 1, a daily passenger, mail, and freight air service was re-established on the line Dresden-Berlin-Hamburg and return; also on the line Dresden-Leipzig-Magdeburg-Hanover-Bremen and return. The trip from Bremen to Hamburg takes four and one-half hours, including a half-hour stop in Berlin. The journey to Bremen requires five hours, including 15-minute stops at Leipzig, Magdeburg, and Hanover.

The fare from Dresden to Berlin is 500 marks and from Berlin to Hamburg 650 marks. This compares with 285 marks and 387 marks, respectively, for the first-class railway fare between the same points. Passage from Dresden to Leipzig is 500 marks and from Leipzig to Bremen 1,300 marks, as compared with 190 marks and 536 marks, respectively, for first-class railway fare between these points. Fifteen kilos of baggage is carried without charge, and all excess at the rate of 15 marks per kilo.

It is reported that a service from Dresden to Prague will be inaugurated in June.

Acting Commercial Attache Cross, Brussels, reports that the "Sneta," a Government-subsidized aerial transportation company in Belgium, has finished its trial period of passenger, merchandise, and postal aerial transport service between Brussels and cities in neighboring countries (Paris, London, Amsterdam, The Hague). Belgian participation on these lines will, therefore, cease from June 1, 1922, leaving the Paris-Brussels and Brussels-Amsterdam services in the hands of French and Dutch companies. A Brussels-London service will be organized by an English company, beginning in May of the present year.

The Belgian Government is studying the creation of a permanent organization which will permit that country to conserve an important position in international aerial transportation.

London-Brussels Service Inaugurated

May 8 saw the inauguration of the new aerial passenger and goods service between Croydon and Brussels, which is being run by the Instone Air Line, under the Government subsidy. The first machine, D.H. 34 G-EBBT "City of New York," piloted by Mr. Barnard, and with passengers, left the terminal aerodrome at Croydon shortly after 10.30 a.m., the departure being witnessed by the Hon. Capt. Guest, Minister for Air; Major-Gen. Sir Frederick Sykes and many other well-wishers of commercial aviation.

This flight was only in the nature of a preliminary trip, a regular daily service being arranged to start on Monday next. It is of interest to note, however, that permission to fly over the Royal Yacht, on its way across the Channel, in connection with the Royal visit to Belgium, had been granted by the King. The machine arrived safely at Brussels at 12.50, having taken two hours two minutes to complete the journey—quite good going. The return trip to Croydon was made later on the same day; photographs for the press of the Royal visit in Belgium forming an important item carried on the machine.

Owing to the engineers' strike, delivery of new machines has been considerably delayed, but it is hoped that before long the Instone fleet will comprise ten passenger machines and two specially built cargo machines, when a regular and frequent service to and from Brussels will be run without in any way interfering with the London-Paris service. Arrangements are being made to book through passengers *via* Brussels to all parts of the East by air. Passengers will be able to go to Brussels by air, spend a few hours, and return to London the same day—which should be a great boon, not only to tourists, but to commercial and business people. It is also the intention of the Instone Air line to run a service to Ostend during the summer months, whilst negotiations are taking place with the diamond merchants to run a "special" once a week to Antwerp, returning the same day.

The London-Brussels route will prove to be an extremely useful one, for Brussels should form an important junction for the various lines to Northern and Central Europe.

Rio de Janeiro and Porto Alegre Air Service

The Brazilian Government has been authorized to establish two aerial routes and air craft services between the cities of Rio de Janeiro and Porto Alegre, an overland route for aeroplanes and a seaplane route along the coast. Both of these routes will, it is proposed, be ready by September, 1922. Although the routes are intended primarily for use by the military and naval forces, and will be organized and controlled by the Ministry of War and the Ministry of Marine, respectively, the facilities they afford will be available for civil purposes, subject to the consent of the Government being obtained, and the payment of a fee and charges for material used.

The Decree authorizes the Government to borrow, up to a maximum of 4,000,000 milreis, to cover the cost of the scheme.

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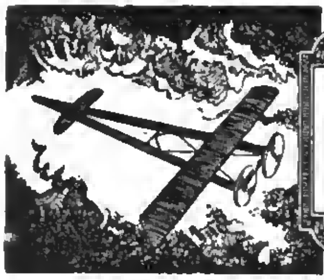
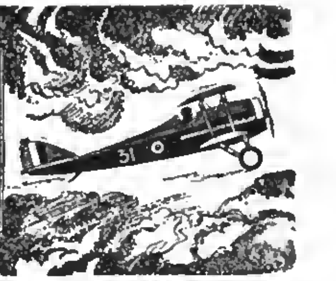


ELEMENTARY AERONAUTICS *and* MODEL NOTES



Scale Models Constructed by Aerial Age Readers

Curtiss JN4D built to scale of 1 inch to the foot

Patterning his model after a JN plane owned by the North-Eartern Aeroplane Co. of Rochester, N. Y., Walter M. Fitch of Canadaigua, N. Y., has completed a scale model which is one-twelfth the size of the original. Great care was taken to carry out all the details and the result is a realistic reproduction. Our readers will recall the Thomas-Morse Scout model built by Mr. Fitch, and illustrated in the January 2d issue of AERIAL AGE.

The description of the JN4D is as follows:

Wing span	43½ inches
Length over all	27¼ inches
Wing chord	4⅞ inches
Gap between wings	5 inches

Fuselage

Longerons are of ⅛" spruce

The cockpits have aluminum seats padded with patent leather. The controls are only in the forward cockpit. On the dashboard of the front cockpit are tiny reproductions of the following instruments: Altimeter, Tachometer, Clock-Compass and very small dials to represent the oil and water-pressure gauges. Both cockpits are equipped with throttles and "sparks" which were cut from aluminum.

Celluloid wind shields are placed in front of both cockpits and rubber tubing padded with fine silk is used to imitate the padding on the big ship. A dummy gasoline gauge is in front of the wind-screen of the first cockpit.

The motor cowlings have openings cut in the usual shape. inspection doors open and are hinged on the inside by means of adhesive tape.

Motor Group

The propeller is patterned after the "D-5,000" type, the kind used on the JN. The "prop" has 5 laminations which are each 1/32" in thickness. The aluminum flange has 8 tiny nails in it to imitate the bolts on the real plane and the hub has a tiny bolt to give a realistic effect.

The radiator was cut from a piece of white-wood. It has 4 lines of wiring to give the "honey-comb" appearance.

Each cylinder was made separately. Rocker-arms were made on strips of aluminum carefully bent and the springs were made of coils of very thin wire.

The eight cylinders were all glued to a piece of ply-wood attached to the upper longerons.

Intake pipes are of ⅛" round wood.

Exhaust pipes are of ⅛" material also and are painted black, but the remainder of the motor is given a coat of grey aluminum.

Undercarriage

The struts of the landing gear are carved from white-wood; streamlining is carried out and silk thread wound around at the proper intervals to imitate the linen thread material which is on the big aeroplanes to strengthen the struts.

Axle is brass, the wheels aluminum with pneumatic tires, and the thin strands of rubber band act as shock-absorbers.

The tail-skid also shock-absorbs and has a "shoe" of aluminum.

Empennage

Control horns were cut from white-wood.

Single strand wire is used to brace the control pylons and the wires running from the control horns are double twisted in order that the wiring may appear like stranded cable.

The hinging is carried out in the same manner as on the large plane.

Stabilizer braces were cut out from ply-wood.

The rudder is painted a blue, with the letters, "2 ROCHESTER, N. Y.," in black.

Panels

The wings are made of bass wood; the ribs being made to scale of the "Eiffel No. 36" wing curve. Near the tip of the trailing edge of the lower left wing the angle of incidence is decreased and on the right wing vice-versa, this done to give the "wash-out" and "wash-in" effect. The "sidewalks" on the lower wings are made of aluminum. The wing-skids are of reed, steamed to the proper shape.

The wiring on the wings is carried out in detail, the landing wires being single, the flying wires double.

Aileron cables are of waxed thread in order to insure good working order. Aileron wheels are made of ply-wood and are ¼" in diameter.

Each upper wing has 18 ribs and the lower 14, as on the big ship.

Over each rib (on wings and empennage) is glued a strip of paper roughed on the edges to represent the frayed cloth which covers the ribs on the original.

Struts are made of white-wood and numbered to indicate their proper location, as on the big ship.

General Notes

The model is painted with the Army "OD" color, which is a greenish khaki, but the rudder and circles on wings are blue.

All the struts are stained with 2 coats of light oak.

Lastly, the model is finished off with a coat of very thin varnish.

A Curtiss-Navy Racer Model

Mr. Bartle J. Allen of 681 Orchard Avenue, Bellevue, Pa., followed the outlines and suggestions for building a flying scale model of the Curtis-Navy Racer as published in the February 13th issue of AERIAL AGE.

Although no long distance flights have been accomplished, the model has "hopped" from forty to fifty feet.

With little additional weight, the fuselage was coated with aluminum paint which adds very much to the appearance. In order to secure the maximum efficiency, a standard propeller was used.

The balsa body is a very light and strong construction, weighing only a little over two ounces. Although very light construction methods were followed throughout, the model is very strong and effective.

The National Scientific Society

The National Scientific Society, founded at Cooper Union, consists of students of Chemistry and Engineering. Among its various departments, the "Aircraft" and "Radio" departments are in majority. It is a society founded for the purpose of "creating and fostering a craving for things scientific" and "to assist, financially and morally, any one or group of members who may be engaged in research or experimental work in any phase of Engineering or Chemistry."

The following is the progress of its "Aircraft Engineering Department":

The membership of the department has reached forty-five, and is rapidly increasing.

Ten models have already been completed and are ready for experimentation. The models consist of rubber power-plant and otherwise.

The department has procured the use of the Cooper Union Laboratories.

Arrangements are being concluded between the society and various model aircraft clubs over the world for the purpose of formulating laws so that international competitions may be held on model aircraft on a recognized basis.

Communications are invited from model clubs, particularly collegiate clubs, to join in this alliance.

The society invites communications from any model aircraft clubs interested in international competitions.

All correspondence should be addressed to Mr. Jacob J. Kuscher, president, Chapter Alpha, National Scientific Society, Cooper Union, New York City.

Models of two Curtiss aeroplanes: above, the JN4D, built by W. M. Fitch; below, the Navy Racer, built by B. J. Allen

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RADIO DIGEST

Government Revenue for Radio Messages Increases

The revenue derived from private and commercial radio messages dispatched from Government stations shows an increase of 2,000 per cent in 1921 over the year 1917. The earnings of these stations is estimated to be in excess of $1,600,000 and shows a profit of more than 15 per cent on the Government's investment of $25,000,000.

In 1917, the first year in which commercial and private messages were transmitted by the Government, the amount received from this source was $32,249.34. In 1918 this revenue was increased to $291,903.03; $221,171.79 in 1919, $641,584.90 in 1920 and $666,362.44 last year.

Approaching Storms Detected by Radio Lose Their Terror

Detection of approaching thunder storms in time to make necessary adjustments in operation of electric service is a valuable practical use of the radio, according to the report of the electrical apparatus committee of the National Electric Light Association presented at the convention in Atlantic City. The radio also serves to detect defects in electrical apparatus and equipment more efficiently than any other agency, the report says.

"The entire radio art has reached an eminently practical and dependable stage," the report continues. "Transoceanic telegraphy on a basis comparable to that of the cables probably represents both the greatest investment and the most spectacular operation. The marine use of radio, including not only ship communication but also position finding for vessels at sea, is of tremendous importance. In Europe wireless telegraphy is coming into extensive use for intercity communication. Some attempts in this direction have also been made in the United States.

"The broadcasting of news and weather dispatches, musical and other entertainments, speeches and church services by radio telephone is providing a valuable service to hundreds of thousands of listeners. Radio has also proved its importance as a wire line auxiliary in the radio field. Train dispatching by radio has been accomplished many times, and some far-seeing railroads have installed radio equipment as part of their permanent plant."

Communication between plants and substations, transmission of instructions to repair gangs along the lines and the possibility of the remote control of switches are given as some of the immediate and important applications. Installation of receiving outfits on automobiles and motorcycles is made where portability is desired. A wide field for remote operation of substations and switches is opened by the application of what is known as the "wired wireless."

"Not the least interesting outgrowth of radiant-wave telegraphy," says the report, "is the application of its principles to communication along wires. It has been found entirely feasible to associate a radio transmitter with a wire system running from one point to another (even though that wire were used for power transmission) and to send along the wire a series of radio-frequency current waves which may be detected at the distant end by means of a simple radio receiver. Such 'wired wireless,' as the arrangement is frequently called, permits considerable economy in operation. It is claimed for this system that fairly clear telephone communication is possible even with lightning storms over the main line and with all but one of the power wires cut or grounded."

Within the last year, and even in the last few months, a number of steps which mark notable progress in radio have been made, the report says.

"Both transmitters and receivers have been improved in effectiveness, economy, reliability and convenience of operation. In radio telephony substantial improvements have been made in clarity of speech transmission, so that now the radio gives a definiteness of articulation far surpassing the wire telephone. Loud speaking apparatus has been developed to the point where purity of reproduction is not sacrificed to gain sufficient intensity. It is now possible to secure reliable radio service of a character never before even approximated."

Nation's Time Governed by Radio Daily

Shortly before 10 o'clock, Eastern Standard time, every evening in half a million homes the ticking of a distant clock is now heard, and the time of as many citizens is daily regulated by it. The ticks come from the clock in the Naval Observatory and are transmitted through the famous long-distance station at Arlington, Va.

Not only do these ticks regulate the nation's clocks throughout the Eastern section of the country, but they also figure very materially in the navigation of practically every steamship plowing its way across the waters of the Atlantic.

How are these signals sent out so regularly and consistently, and how are they reproduced from the broadcasting stations? That is the question that is of the greatest interest to the radio fan.

In the first place, the signals themselves are produced by the clock in the Naval Observatory in a very novel manner. The pendulum on the clock, swinging across its arc of travel, makes contact with a piece of metal every time it passes through its perpendicular position, and it is so arranged that it makes one complete swing every second.

As the pendulum passes across the contact it closes a local circuit, which in turn operates the transmitting apparatus at Arlington and thus sends out the brief dashes that are so familiar.

Now, as is well known, these signals are sent out on a wave of 2,600 meters in length, while the broadcasting stations are operating on 360 meters. The consequence is that the broadcasting stations which reproduce them must actually receive and transmit at the same time.

This fact is not generally appreciated by the average radio fan, and it offered a very serious problem to solve, especially as it was desired to reproduce in all faithfulness the exact note of the Arlington station. It must be realized that in the case of the broadcasting station the receiving aerial is not more than a few feet away from the transmitting aerial. The problem, therefore, was to eliminate the inductive and radiation effect of the transmitting aerial from the receiving aerial so that it would not interfere with the true note of Arlington.

Another difficulty that had to be overcome was the amplification of the weak signals received from Arlington without distorting them or changing their characteristics, because as received they were too weak to operate upon the transmitting apparatus of the broadcasting station.

I have listened several times on sets so arranged that it was possible to change quickly over from the 360-meter wave length to the 2,600-meter wave of Arlington, and the astonishing thing was the wonderful exactitude of the reproduction from the station broadcasting.

At the broadcasting station radio amplification is used to build up the current received in the antenna there before it is passed for rectification through the detector tube. The audible frequency of the Arlington quenched spark is then passed through audio-frequency amplifiers, and finally delivered into a special telephone receiver.

This receiver is attached to a telephone microphone transmitter of special design, and then placed into the modulator tubes of the transmitting apparatus and reradiated on the 360 meter wave, so that all of the radio fans listening on their short wave receivers can obtain the correct official time every evening.

The remarkable thing about the whole transaction is that there is absolutely no loss of time in the transference from one wave-length to the other, and this is a very important factor to those who desire to set chronometers by means of the short wave reproduction of the time signals.

The manner in which the signals are transmitted from Arlington is as follows: The ticks are reproduced, starting from 9:55, Eastern standard time, every evening. Each second is sent out as a short dash, which is reproduced in the telephones. The tick of the twenty-ninth second of every minute is skipped, leaving quite a distinctive space. At the end of each minute the signals are omitted for several seconds, making a longer pause. At the end of the fifty-ninth minute after 9 o'clock the signals are omitted for ten complete seconds, which, of course, is much more noticeable. This longer pause also permits the operator of the broadcasting station to announce over the 360 meter wave his famous: "The next dash will be 10 o'clock."

One of the officials of a broadcasting station made the following suggestion:

"A convenient way to check your watch is to follow the second hand during the first part of the signals, thus noting the position of the second hand relative to the end of the minute. The minute hand should be observed during the fifty-ninth minute and checked with with the signal for 10 o'clock. In this way you can tell exactly how many minutes and seconds your watch needs to be changed in order to absolutely correct time."

Radio Cuts Message Cost

It is estimated that by using radio to keep in touch with various army headquarters and posts the War Department will reduce the communication expense more than 40 per cent. Formerly all offi-

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cial messages were dispatched over the wires of the commercial telegraph and telephone companies. Radio now is used almost entirely.

Double Circuit Set Reduces Interference

How can I eliminate interference from other stations? That is the question which bothers most of the radio fans, and the answer to it is bound up in the construction of the receiving set itself. A large number of sets now on sale, and in use employ what is known as a single circuit receiver. They have been so designed because of the desire to give to the novice an instrument that will be as simple as possible to operate and to adjust. For the purpose of selectivity, however, such a set is not nearly as efficient as a double circuit receiver.

In this article, I propose to outline the functioning of the double circuit set and in doing so it will be necessary to describe the vario-coupler and the loose coupler and explain the manner in which both of these two instruments operate. It will be helpful to those who are making or assembling their own equipment, as well as to those who have installed sets that are manufactured complete. In the first place, with a double circuit receiver, we have two complete and independent circuits, as the name naturally implies. The first is the aerial or antenna circuit, which consists of the aerial and an aerial tuning inductance and a ground connection. In some cases, the addition of a condenser in series with the aerial and the tuning inductance is included. This description of the aerial circuit sounds imposing, but in realty it is very simple and merely consists of the aerial wire and then the primary winding of the vario-coupler, or the loose coupler —whichever is used.

The next circuit is called the secondary circuit and consists of an inductance and a condenser. Now these two circuits taken together form what is technically known as oscillating circuits, or in plainer language the circuits which handle the high frequency currents pcked up out of the ether.

The object of using two circuits is as follows: By carefully adjusting the aerial circuit we set it into resonance with the station we desire to listen to, just in the same manner as two tuning forks pitched to the same tone are in resonance with each other. In the natural course of events, however, every electro magnetic disturbance in the ether passes over the aerial to the ground. If the aerial circuit is not in resonance with any particular wave, it will not oscillate to it—that is, theoretically it should not do so. In practice, however, we find that it does, and this is the cause of interference which of course will be recorded into telephone receivers where only a single circuit is being used. Now, with the addition of a secondary circuit, which is also carefully adjusted, we eliminate still further the possibility of interference by increasing the number of circuits that have to be in oscillating resonance with each other.

There are two main methods of installing a double circuit receiver—one is by the use of a loose coupler, which is now more or less discarded, and the other is by means of the vario-coupler.

The loose coupler consists of a primary inductance, which is nothing more or less than a wire wound around an insulated tube in such a way that we have a certain number of turns on the tube. The more turns of wire there are upon the tube, the longer is the wave-length that it will respond to.

The secondary of a loose coupler consists of a winding on another tube, which is so arranged that it will slide in and out of the primary tube. In fact, it will come completely out of the tube, and can be pulled away quite a few inches clear of the primary tube. In this manner we have three possible adjustments—first, the number of turns on the primary that we can bring into play in the primary circuit; second, the number of turns that we are bringing into the secondary circuit, and finally the inductive relationship between the two coils themselves, which is technically known as "close" or "loose" coupling. The object of this loose coupling is to eliminate the effect of interference by loosening the coupling between the two coils. It has been found in practice that when the primary and secondary circuits are in resonance with each other the two coils can be separated quite a distance and signals still be recorded in the telephone receivers, whereas signals that are not in resonance with the circuits will be eliminated by widening the coupling between the two coils.

Experience, however, showed that there was a considerable inductive loss when loose coupling was used and this led to the development of the vario-coupler, which is a much more efficient instrument. It has this drawback, however, that the secondary winding is not variable, but this is overcome by the addition of a variable condenser placed across the ends of the secondary coil.

Now the vario-coupler consists of a primary exactly the same as the primary of the loose coupler, although it is invariably wound on a tube of larger diameter. The secondary is wound on a ball, or rotor, which is so arranged inside of the primary tube that it can turn around in a complete circle. When the windings of the secondary of the vario-coupler are exactly parallel with the winding on the primary, there is a maximum induction between the two. This induction is decreased by turning the secondary, or rotor, in such manner that the windings assume an angular position in relation to the primary winding. This has the same effect as withdrawing the secondary in a loose coupler, but it has the advantage of not taking the secondary coil out of the maximum electro-magnetic field, and in this manner we obtain much greater efficiency in operation.—Jack Binns in *N. Y. Tribune.*

How to Keep Radio Safe in Lightning

One of the most debated questions among radio amateurs and broadcast listeners is whether a man who hangs out an aerial hangs out at the same time an invitation to every lightning bolt in the vicinity to come and pay him a visit. The warmth of the debate reaches its greatest height when one of the participants is the unscientific but forceful landlord of an apartment house and the other is a tenant.

The question is answered by G. K. Thompson, radio superintendent of the American Radio and Research Corporation, as follows:

"You should harbor no fear that your radio installation will attract lightning. The chances of lightning striking your home this summer are no greater than the chances last summer. You should make it a point, however, to install such safety devices as will render harmless the currents induced in your antenna by lightning bolts striking in the neighborhood."

Mr. Thompson, in discussing lightning, divided the subject into three parts, the protection of the house, the operator and the set.

He suggests for the house the installation of a lightning switch or a grounded short gap of approved design, avoiding the purchase of slate base, switches, gaps or other devices, which do not support the ground conductor at least five inches out from the wall of the building. A good ground conductor should be used, running directly as possible to a good ground connection, such as a water pipe.

"Have the installation approved by your local inspector," he advises, "so that in case any damage to the building by lightning ever comes to pass, the validity of the radio installation will not be questioned."

In considering the protection of the radio set itself from possible damage from heavy electrical discharges Mr. Thompson says:

"The best precaution to follow is to disconnect the antenna and ground lead wires from the terminals of the set before the thunderstorm breaks. If you do not care to disconnect the set a protected gap should be purchased and connected across the antenna and ground terminals on the instrument. A substitute for such a gap can be provided in the form or a burnt out flashlight bulb screwed into a miniature base, the terminals on the hase being permanently connected to the antenna and ground terminals of the receiving set. If the latter terminals are mounted close together a discharge gap may be provided by clamping two ordinary sewing needles in the terminals, separating the points by the thickness of a piece of paper. For maximum protection, however, complete disconnection of the receiving set from antenna and ground connections is advised."

These suggestions are made for personal safety:

Don't attempt to operate the set while a local thunder shower is in progress. You can hear nothing but static discharges, the elimination of which is entirely beyond your control.

Don't touch the ground wire or the antenna lead wire while the storm is in progress.

If you use a lightning switch don't touch it while the storm is in progress, even though it may not be set in the grounded position.

Fire Department to Install Radio

Fire Commissioner Drennan of New York City has given his official sanction to the installation of radio receiving apparatus in the fire houses of the New York department, subject to regulations.

A number of the fire houses have judiciously had receiving apparatus which the men had purchased and installed that there has been some division of opinion as to the property of such equipment on city owned property without official approval.

In his approving statement Commissioner Drennan points out that radio will furnish diversion and healthy recreation for the firemen and help to relieve the monotony of engine-house life.

Apparatus may be installed at the expense of the firemen themselves, after written applications containing a sketch of the plan of the proposed installation has been approved by the chief of the Bureau of Fire Alarm Telegraph, Mr. Val Fendrich, and also by the Department of Water Supply, Gas and Electricity, which has jurisdiction over all electrical appliances in public buildings.

No broadcasting or transmitting sets will be allowed in the fire houses.

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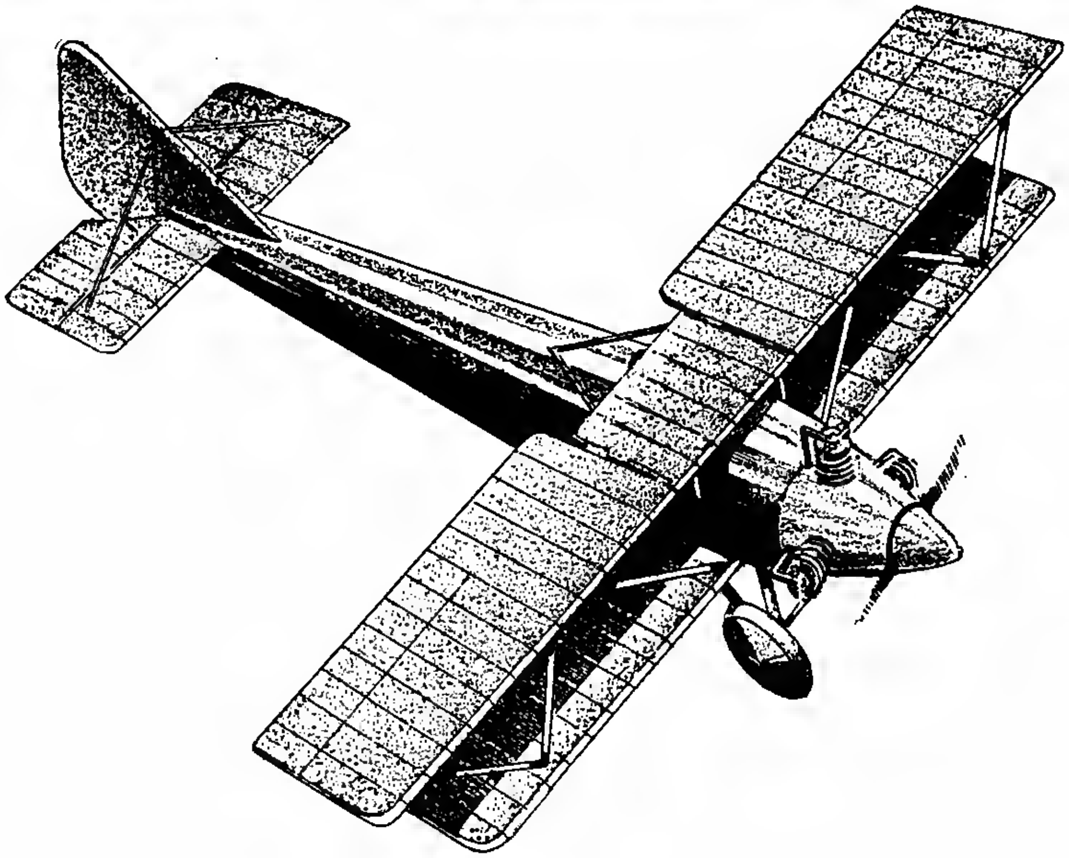
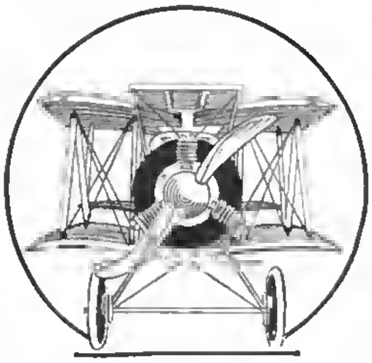


The New Longren Airplane



The illustration above shows how the wings of the Longren Airplane may be folded back for housing purposes, without disturbing the setting of the wings or controls.

DESIGNED by A. K. Longren—one of the pioneer airmen of the West—the New Longren Airplane meets all demands for a safe, rapid and comfortable plane, to be cared for and operated by the owner.

This new plane is pleasing in appearance—simple and sturdy in construction. Its operating cost is low. Folding wings make housing a simple matter. It has a quick take-off with rapid climb, and responds instantly to the controls.

Only the highest-grade materials are used in the manu facture of the New Longren Airplane. In a recent letter to us Mr. W. D. Wallace, Secretary of the Longren Aircraft Corporation, says: "We use Valspar exclusively, for the very good reason that after exhaustive tests, we were unable to find any varnish or enamel that could compare with Valspar and Valspar Enamels."

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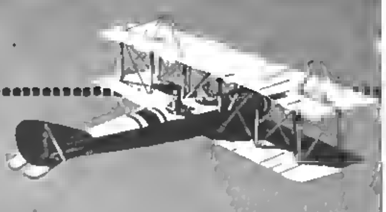

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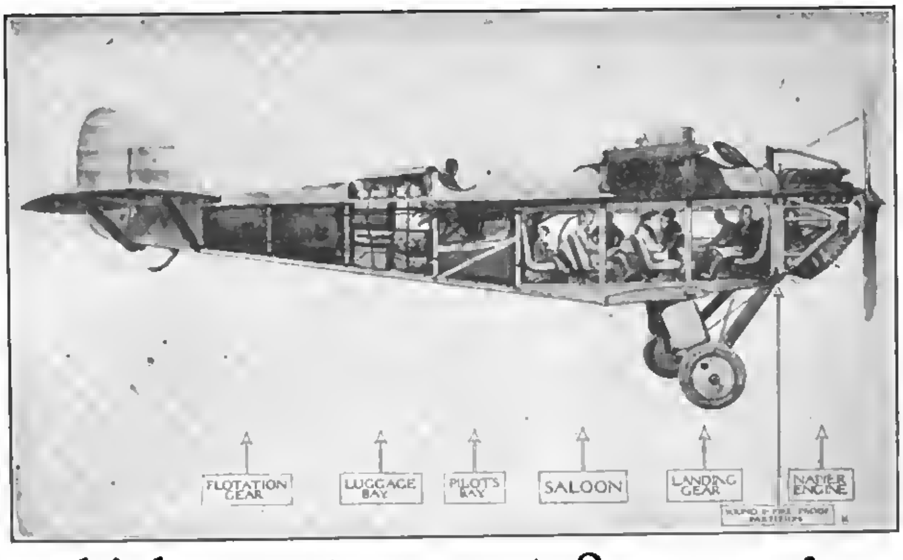

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(Concluded from page 296)

veniently organized as a committee of International Chamber of Commerce established in 1920 after the Congress called at Atlantic City in October, 1919. The main function of this organization should be to coordinate the work of the various aeronautical Chambers of Commerce, aero clubs and similar organizations throughout the world.

The constructive work which could be accomplished by both the international organ of coordination of aeronautical Chambers of Commerce, aero clubs and other aeronautical organizations is simply invaluable. All matter pertaining to international regulation of flight, standardization, licensing of pilots, testing of aircraft, wireless and meteorological services, organization of airdromes and airways, rules for complying with costume and passport regulations, transhipment of mail, passengers and merchandise, could be thoroughly investigated by specialists and satisfactorily settled. These two organizations would be of tremendous help to the various governments in suggesting the right kind of legislation needed to promote and to further the development of aeronautics all over the world.

In the meantime, while we have not any such organization it is up to our aeronautical Chamber of Commerce and to the Aero-Club of America to do whatever they can in order to encourage commercial aviation developments in this country, to keep us closely in touch with the aeronautical situation all over the world and to cooperate to the best of their ability with similar organizations in Europe for promoting a true spirit of international cooperation between aeronautical interests in the world on matters of common interest, this being the condition *sine qua non* for succeeding in putting aeronautics on the map of the world as a practical and safe international means of transportation.

However, more than anything else, what we need at the present time is to get started, to stop discussing projects with regard to commercial aviation developments, and to actually start something. As I said before, the logical start is the inauguration of a regular service for the transportation of mail and merchandise between New York and Chicago, with the right flying equipment bought in the United States at the right price from aircraft manufacturers having sufficient faith in the quality of their aircraft to be willing to become stockholders in the company operating them. After this company has been started right, let all the financial groups interested in commercial aviation developments in this country concentrate their efforts in building it up and making it the corner stone of our commercial aviation activities.

Let us not have competition in the beginning of this game—there will be plenty of opportunities for promoting developments in the future through competition. What we need for the first year or two is cooperation: cooperation between financial interests in creating first a strong aerial operating company; the cooperation of the government, express companies and the public at large in patronizing this new means of transportation; the cooperation of aircraft manufacturers in providing good aeroplanes; the cooperation of the communities in providing landing fields; and the cooperation of Congress in enacting without any further delay the right kind of air legislation.

If the first aerial transport company is able to start operating under these conditions, inside of a few years we shall lead the world in commercial aviation developments.

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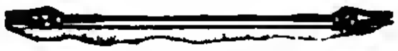
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Canucks $850 and up; Curtiss JN4D's $650 and up; JN4D specials $1350 and up; J-1 Standard with almost new motor $1350; J-1 Standard, less motor, ready for OX $1100. J-1 Standard, less motor, just as received from Gov't in original boxes $800. 8-Pass. Standards with choice new 150 to 100 H.P. Motor $3150 to $3600. Orioles $3000 to $4800.

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AERIAL AGE WEEKLY

VOL. 15, No. 14 JUNE 12, 1922 10 CENTS A COPY

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215 " " " used.
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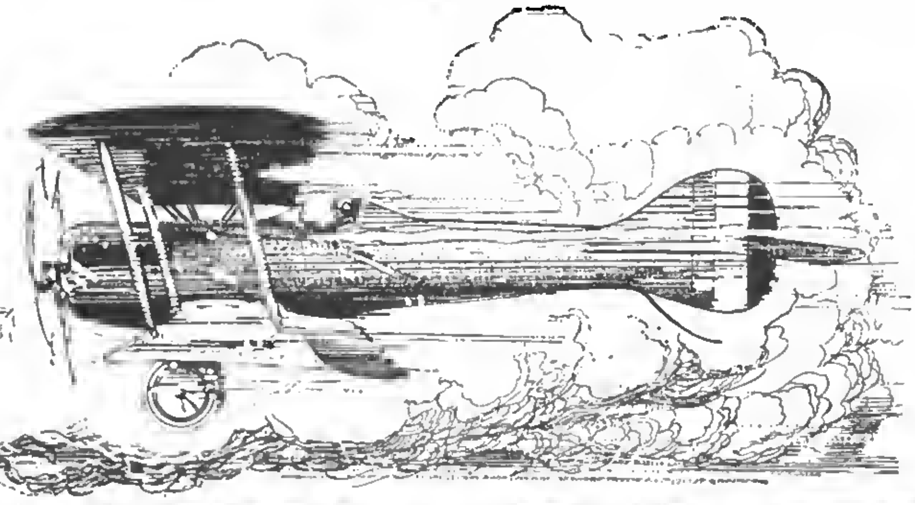

WAR DEPARTMENT

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June 12, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 14

TABLE OF CONTENTS

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VOL. XV NEW YORK, JUNE 12, 1922 No. 14

Sea and Air Power

MR. ARCHIBALD HURD states the case in the manner of a partisan when he says in an article upon sea power and air power in *The Fortnightly Review* that "this country (England) is being challenged to prepare to confront entirely novel conditions of life; the ship of commerce, like the ship of war, is to disappear, and we are to receive the greater part of our food as well as the raw materials for our factories by aeroplane or airship, and are to conduct our export trade by the same means." That is going too far in reflecting the opinions of the aircraft advocates. Mr. Hurd is as little disposed as the Admiralty to accept the view of Sir Percy Scott that the battleship is passing into the obsolete class. He speaks with scorn of the retired naval officers "who have little or no personal experience of war and even less of commerce who have been throwing up their hats in enthusiastic support of this conception of an island country without ships of war or ships of commerce." Admiral Sir Percy Scott, by the way, is a retired naval officer, but during the war he put London in a state of defense against aircraft attack with little, if any, practical help from the Admiralty. In a normal year Great Britain imports and exports 150,000,000 tons of goods and products. Certainly Sir Percy Scott and other believers in aircraft do not hold that Great Britain can dispense with surface ships in her ocean-borne trade. Mr. Hurd argues lamely, as well as intemperately, when he says:

"There are nearly 4,000 large unarmed and, for the most part, slow merchant ships under the British flag. Is it imagined that an enemy desiring to strike this country a vital blow would devote attention to the few swift and powerfully armed men-of-war, when so many more desirable targets, in tbe shape of merchant ships and their cargoes, were presented to attack?"

In the first place, this is to assume that international law will never again be observed in warfare; and in the second place, it is to lose sight of the fact that Great Britain already possesses a strong aircraft arm for offense and defense, and will continually add to it. Should an enemy copy in the air the methods of warfare the Germans practiced under the sea, Great Britain would be well prepared. She is giving a great deal of attention to the development of aircraft.

We are told that "it is today the considered opinion both of the Naval Staff and the Board of Admiralty that defense against aircraft, so far as capital ships are concerned, is, and will keep, fully abreast of attack, whether by aircraft or submarines." But the Admiralty is far from infallible. When the war with Germany came it underestimated the potentialities of the submarine; it had little faith in the aeroplane as a fleet auxiliary; it was satisfied with the construction of capital ships that proved defective at Jutland; the shells used were not as damaging as the enemy's, and the machinery of gun elevation on the British fleet was not uniformly serviceable. Really the Admiralty is not a satisfactory authority upon defense against aircraft. Between the Admiralty and the Air Ministry there is a chronic feud.

Mr. Hurd summarizes the report of the Committee of Imperial Defense when he says: "It was held that in aircraft resided great possibilities of development, but that, in spite of the aeroplane, the airship and the submarine, the battleship, and therefore other types of men-of-war, remained practically unchallenged." "Practically unchallenged" is an unfortunate expression. Not only Sir Percy Scott but our own Admiral Sims maintains that the aeroplane successfully challenges the effectiveness of the surface warship.

It is true that the American Joint Army and Navy Board reported that "the battleship is still the backbone of the fleet and the bulwark of the nation's sea defense, and will so remain so long as the safe navigation of the sea for purposes of trade or transportation is vital to success in war." But at the same time the Joint Board also pronounced this judgment: 'The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy." Mr. Hurd is more impressed by the primacy given to the battleship than to the apprehension that the airship has alarming potentialities. None, however, but extremists who give free rein to their imaginations think that there can be a one-standard fleet operating only from the air, nor that surface cargo-carriers are obsolescent, soon to be succeeded by argosies of heavily freighted flying ships. As well maintain that railroads cars are to be scrapped, and the tracks torn up or abandoned to the elements. So long as the Seven Seas wash the shores of the world there will be ships of war and ships of commerce, and on land most of the carrying business will be done by the railroads and the motor car. Cost alone will limit the use of the airship in trade.—*Editorial in N. Y. Times.*

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The News of the Week

Pulitzer Trophy Spurs Army Airmen

Dayton.—The United States Army Air Service will make a determined effort to win the Pulitzer Trophy in the international air race to be held at Detroit on September 15.

Announcement was made May 25 that orders had been placed for six special speed planes to be entered in this tournament. In addition, the Verville-Packard plane, winner of the 1920 classic, will be entered.

The contracts for the six speed planes were let to the Thomas Morse, Curtiss and Loening aeroplane manufacturing companies. Their construction will be rushed and they will be taken to Detroit on completion for final flight tests. Structural tests will be made at the different plants.

Major T. H. Bane, Commandant of the Engineering Division of the Army Air Service at McCook Field, said the provisions called for a guaranteed speed of approximately 200 miles an hour and what other equipment can be included in the construction to make the ships formidable contenders in the race. Contracts were drawn by the officers at McCook Field. The McCook Field entry has been undergoing a general overhauling, under the personal supervision of Alfred Verville, its designer. When this ship won the 1920 race it attained a speed of 186.7 miles an hour and was not operated at full speed. It was piloted by Lieut. C. C. Mosely of McCook Field.

Paris-London Aeroplane Falls Into Channel

A French aeroplane flying from the air station at Croydon, near London, bound for Paris, fell into the English Channel June 3. The pilot and two passengers were drowned. A cross Channel boat picked up two bodies. The accident occurred three miles from the English coast. It was observed from a Channel boat crowded with Whitsuntide holiday makers, which proceeded to a spot where the aeroplane fell.

The passengers were Gordon Ley, an Englishman, and Paul Carroll, a Paris business man. The British machine on which the two passengers had booked for the flight to Paris was not ready when they arrived at the Croydon airdrome this morning and they therefore were transferred to the French machine. Carroll's brother refused to make the flight.

Tennessee National Guard Squadron Gets Into Action

"All things come to him who waits" fittingly describes the 136th Squadron, Observation, Tennessee National Guard, which was Federally recognized in December, 1921. For many weeks the squadron "carried on" under very adverse conditions. Finally, a consignment of four JN6H's arrived, and immediate action was started to set them up the week following the completion of the first steel hangar. In the meantime the second hangar was completed, and the four H's have been set up, but lack of tools prevented the installation of motors.

Through the kindness of Major Roy S. Brown, a DH was loaned to the Regular Army Instructor, and on May 7th he flew it up to Nashville from Montgomery, bringing the necessary tools. He was accompanied by a mechanic, Staff Sergeant Baehre, of the 22nd Squadron Observation. The plane was flown back on May 10th, and in the near future a DH will be permanently assigned to the Instructor.

Much difficulty has been experienced in obtaining equipment and supplies, due chiefly to lack of funds for freight and express charges. The transportation problem has been relieved through the kind and generous cooperation of the Commanding Officer at the Old Hickory (the former government powder plant), the Ordnance Depot, and the Tennessee State Highway Department.

The State has erected on the field an administration building, containing an office, orderly room, armament room, operations room, supply room, and a small medical clinic. Needless to say, it has been of great value since its completion.

On March 28, 1922, Lieutenant Vincent J. Meloy, Air Service, formerly commanding officer of the 8th Squadron (Attack), reported to the Adjutant General's Office, and shortly thereafter the squadron launched forth into its first training schedule. For the officers it consisted mainly of classes in Infantry Drill Regulations, Field Service Regulations, Manual of Courts Martial and some practical work witb the D-R system of signalling. The enlisted personnel were given lengthy periods on the school of the soldier, squad and company, and practical work on rigging and motors.

The field is situated on the Lebanon Pike, adjoining the Hermitage, the home of Andrew Jackson. It is about 12 miles northeast of Nashville and about two miles south of Old Hickory. The hangars and administration building border the south side of the field, which is approximately 2200 feet square, with good approaches on all sides. A white circle, 50 feet in diameter, marks the center of the field.

Much credit is due Major J. C. Bennett, Jr., Air Service, Tennessee National Guard, the officers and enlisted men of the squadron, Major Baxter Sweeney, former Adjutant General, and Brigadier General P. I. Brumit, the present Adjutant General, for their perseverance, hard work and untiring efforts in getting the 136th under way. A word of praise is also due the Nashville Commercial Club for their efforts in behalf of the squadron.

World Flyers' Plane Smashed at Marseilles

Marseilles.—Major W. T. Blake was compelled to make a forced landing at Borely Park, just outside Marseilles, May 28, while on a flight from Lyons to Turin, Italy, in the continuation of his attempt to fly around the world.

The machine struck on rough ground, damaging the running gear and smashing the propeller. It is being towed to the Miramis aviation field for repairs and the flight probably will be delayed for several days. Neither Major Blake nor his companions, Broome and MacMillan, was injured.

Air Bomber Hits Target Three Times at 3,000 Ft.

Lieutenant Victor E. Bertrandas hit the Rock-and-Rye at an altitude of 3,000 feet three times running May 30, in a demonstration of aeroplane bombing at Mitchell Field, Long Island. He was not unduly elated when he descended, however, for Rock-and-Rye was the name given to a warship model of wood and canvas, twenty-five feet long, which served as a target.

At 2,500 feet Lieutenant Bertrandas missed the Rock-and-Rye by 100 feet. He mounted to the 3,000-foot level and dropped five more bombs, the first three of which landed fairly on the target, which burst into flames. A brisk wind was blowing at the time. Lieutenant L. V. Bean was pilot.

There was a ten-mile relay race at the army held also, in which each contestant used two aeroplanes and made the trip from the first to the second in a wheelbarrow. Lieutenant F. C. Fishback won. Captain I. S. Eaker won another ten-mile aeroplane race.

Plane Wins 105-Mile Race Against Stork

Norfolk, Va.—An aeroplane, fitted out like an ambulance, won a race with the stork May 30. It was a 105-mile race. The patient was landed safely at the door of the Public Health Hospital in this city and at last reports was doing well.

Mrs. W. N. Wilds, wife of a coast guard at Chicomico, N. C., was the patient. She stood the air trip well and was attended by the doctors during the entire flight.

Urgent calls for a doctor were sent out from the Hatteras radio station to the coast guard division headquarters today. No doctor for Mrs. Wilds could be procured in the little coast guard settlement at Hatteras.

Captain D. F. A. Deeote, coast guard division commander here, ordered a plane and doctor from the naval base. Dr. Engel was routed from bed and the plane, one of the fastest at the base, departed for the coast guard station. The stork was expected this morning and the local doctor, who had promised to come, telegraphed from twenty miles away that impassable roads would keep him from arriving at Mrs. Wilds's bedside.

Aero Club of El Paso

Unusual interest is being displayed by former officers of the Air Service in the organization of the Air Service of the 90th Division Organized Reserves of which El Paso is the headquarters.

For some few months the former army air service men have been getting together at a weekly noon luncheon as well as at other get-togethers for the purpose of bringing out the "T."

Just recently Lieut. Morris has been assigned to El Paso for the purpose of organizing the air service reserves and almost without exception the men have signed up for reserve commissions.

Not a small amount of flying talent is represented by our club. We have many overseas men and three of our members were members of that famous Kosciuszko squadron which was so effective with the Polish army against the Bolshevists. These men are Earl F. Evans, E. W. Chess and Bob Slaughter.

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The AIRCRAFT TRADE REVIEW

Rickenbacker on 15,000-Mile Air Tour

Just as we go to press announcement is made of what is termed the longest flying venture ever planned from Mitchel Field, near Garden City, L. I., when Edward V. Rickenbacker, during the war America's premier ace and at present an official of the Rickenbacker Motor Company, and three companions will set out on an aerial industrial survey of the United States. In three months of constant travel over almost every State in the Union, Rickenbacker will stop at sixty-six of the more important cities of the nation.

On the completion of the flight, which is scheduled to end in Detroit, Mich., about September 1, Mr. Rickenbacker will forward to Major General Mason Patrick, Chief of the United States Air Service, a report on aeronautical conditions viewed from the angle of reserve national defense throughout the country. This report will be supplemented with information regarding emergency and permanent landing fields, meteorological conditions and the status of public interest in flying.

Mr. Rickenbacker said he had accepted invitations to address various organizations on aviation in cities where stops are to be made. He estimated it would be necessary to travel eight months by rail and motor to accomplish the survey he contemplated completing in three months.

"We can do a month's traveling in less than a week by plane," he said. "We plan to spend every night in a hotel instead of bumping along over the rails in a Pullman berth. The information we will seek has long been needed."

Accompanying Mr. Rickenbacker will be Edward Stinson and Lloyd Bertand, two of the leading flyers of this country, and Steve Hannigan, a writer, who will act as historian of the trip. The first leg of the flight will be from New York to Detroit, where the party will stop over night and "hop" to Chicago on Wednesday. The flyers will travel in a Junker all-metal monoplane equipped with a 185-horsepower BMW motor. The passenger cabin is entirely enclosed and fitted with electric lights and other conveniences.

In connection with the proposed trip of Rickenbacker the Aeronautical Chamber of Commerce yesterday gave out a statement based on a report submitted to the Secretary of Commerce that 3,000,000 miles in cross-country flights without a fatality was the safety record of aviation in this country for 1921.

In signed statements, 125 operators in all parts of the United States having an equipment of 600 planes showed that in twelve months they had made 130,736 flights, carrying 122,512 passengers 2,907,245 miles. Including the flights made by "gypsy" pilots the Aeronautical Chamber of Commerce fixed the number of miles flown at 3,000,000.

Aerial Advertising

A novel newspaper advertising stunt has been attracting London crowds and giving them the aviation neck as they watched an aeroplane high in the sky write with a stream of white smoke the letters "Daily Mail." The stunt was first tried on Derby day when betting on the big race was active.

The machine was easily 10,000 feet in the air, where there was no wind. When the word "Daily" had been written and the aviator was maneuvering to begin a new word the bookies asked what odds people would lay as to which one of half a dozen newspapers would be named. The smoke hung against the blue background and the letters were distinct for some time. The plane carried a smoke generator and powerful ejector, which forced jets of smoke in the trail of the machine as it climbed up and down in the air. It was estimated the space occupied by "Daily Mail" in the sky was more than three miles wide.

The Decay of a Simple Eddy

This report (No. 144) by H. Bateman of the National Advisory Committee for Aeronautics, deals with a generalization of Taylor's formula for a simple eddy. The discussion of the properties of the eddy indicates that there is a slight analogy between the theory of eddies in a viscuous fluid and the quantum theory of radiation. Another exact solution of the equations of motion of a viscuous fluid yields a result which reminds one of the well-known condition for instability in the case of a horizontally stratified atmosphere.

A copy of Report No. 144 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Prest's Plane Damaged

Cheyenne.—C. O. Prest, aviator, attempting to fly from Buffalo to Siberia, was unable to continue his flight from this city May 29 because of damage done to the wings of his airplane by a hailstorm the day before.

Carlstrom Field to Be Closed

Tampa, Fla.—Uncle Sam has finally decided to abandon the Carlstrom aviation field at Arcadia, Fla., as soon as the cadet class, which is now in training there, is graduated, it has just been announced by Maj.-Gen. M. M. Patrick, chief of the army air service, who has completed an inspection of the field.

An announcement that the war department would transfer the field's training activities to a Texas camp was made some time ago, but vigorous protests from all parts of Florida arose and the matter was given more thorough consideration.

General Patrick stated that there was no fault to be found with the flying conditions at Carlstrom and that the field had done a great work for the army, but it is a part of the pressure of economy to close numbers of aviation fields. The fields which are to be retained, most of them being in Texas, are equipped with greater housing facilities than is Carlstrom. The date of abandonment has been set for some time in June.

COMING AERONAUTICAL EVENTS

AMERICAN

Sept. 4.—Detroit Aerial Water (*about*) Derby, Detroit. (Curtiss Marine Flying Trophy Competition.)

Sept. 15.—Detroit Aerial Derby, (*about*) Detroit. (Pulitzer Trophy Race.)

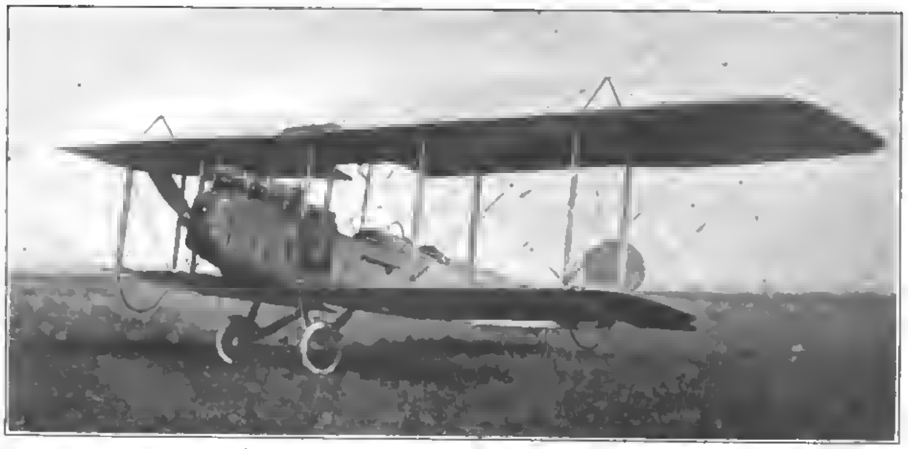
Sept. 30.—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1.—Coupe Jacques Schneider. (*about*) (Seaplane speed race.) Italy, probably Venice.

Aug. 6.—Gordon Bennett Balloon Race, Geneva, Switzerland.

Oct. 1.—Coupe Henri Deutsch de la Meurthe. (Aeroplane speed race.) France. American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.



The Chamberlin-Standard 1-F3 Three Place Biplane

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REGULATION OF AIR TRAFFIC

By DEVALUEZ*

CONSIDERING the progress of aerial navigation, the importance of uniform laws and the necessity of establishing certain principles and regulations intended to avoid controversies, and animated with the desire of aiding the development of international aerial communications for the purposes of peace, on October 13, 1919, the signatory governments of the peace treaty established a convention regulating aerial navigation.

The high contracting parties, while recognizing the complete and exclusive sovereignty of each power over the air space above its own territory, studied all cases susceptible of creating litigation between the different governments due to international aerial navigation and established laws accordingly.

With the observation of these laws, each government contracted to accord, in times of peace, to the aircraft of the other signatory powers of the convention, the liberty of inoffensive passage over its territory.

Without awaiting the signing of the protocol of this convention, most of the countries made special agreements with the countries to which they were joined by air routes and published special rules regulating the circulation of their aircraft over their own territory.

Thus France made agreements with Great Britain, Switzerland and Holland, and a decree was signed July 8, 1920, regulating aerial navigation in France. This decree, together with the bill subsequently submitted to the Senate, inspired the international convention and differed from the latter only in certain details.

It appears, therefore, that we can study concurrently the regulations for international aerial traffic established by the convention of October 13, 1919, and the French regulations established by the decree of July 8, 1920. These two sets of regulations supplement each other, the second being the practical application of the principles contained in the first.

The principal questions covered by the present legislation are as follows:

1. Conditions of safety which must be fulfilled by aircraft.
2. Licenses for members of the crew.
3. Traffic rules to be observed by French and foreign aircraft.

To these regulations there must be added those connected with the customs laws and the measures adopted by each country for its national defense.

Such are the broad lines of aerial regulation, which will be briefly expounded in the present article, some of these questions, moreover, needing to be the subjects of special communication.

Safety Requirements of Aircraft

Both international and French legislation require that no aircraft shall be operated without a certificate of navigability. This certificate, as defined by the French decree, is the attestation of the safety characteristics of the aircraft.

For the purpose of requiring guaranties as regards the safety characteristics of an aeroplane used for commercial purposes or for air travel, the French regulations impose a series of tests for new aircraft types and supervision of quantity production of aircraft.

The following procedure has been adopted and seems capable of giving all the necessary guaranties. The builder of a new type of aircraft must present his machine to the Technical Section of Aeronautics, which will subject it to static and flight tests. These tests will show whether the aircraft has a large enough factor of safety and whether its characteristics and performances fulfill the requirements of the use for which it is designed.

After the tests have been made on the sample aircraft its quantity production is supervised by the Section of Aeronautic Construction, which makes sure that the aircraft thus produced is an exact copy of the sample, both in its characteristics and in the nature of the materials employed in its construction. In quantity production any aircraft that has undergone modifications susceptible of affecting its characteristics and performances must be subjected to the same tests as the original sample.

After the tests of a new type have been completed and adjudged satisfactory, its construction being under the control of competent parties, the aircraft may receive its certificate of navigability, and as soon as it is employed it comes under the control of the Aerial Navigation Section.

This section determines, at longer or shorter intervals, according to the use made of the aircraft, whether it continues to meet the safety requirements for holding the certificate of navigability. According to circumstances, the certificate is continued if the aircraft is in proper condition, or suspended if it is temporarily unavailable on account of undergoing repairs, or permanently withdrawn, if it is unfit for further use.

An aircraft, on receiving its certificate of navigability, also receives its books, consisting of a route book, an aircraft book and an engine book. These books, which must be kept strictly up to date, render it possible to control the use of the aircraft, to comment on the routes followed and to keep track of incidents of navigation, accidents and repairs made.

Licenses

In order to take his place as an authorized member of the crew of a public aircraft for transportation or touring, any person performing the functions of pilot, navigator or mechanic must have a license or certificate. These certificates, which attest his physical and technical qualifications, comprise:

1. License as touring pilot, which does not confer the right to serve on a public aircraft, no matter in what manner he may be remunerated.

2. License as public transportation pilot, which gives him the right to carry passengers or freight for pay.

In each of these two classes (touring and public transportation) there is a special license for pilots of naval aeroplanes and seaplanes, by reason of special qualifications considered desirable for piloting such aircraft.

3. License as pilot of free balloon.

4. Three licenses (first, second and third class) as airship pilot. The holder of a license of the first class can command all kinds of airships. The holder of a second class license may command airships of less than 20,000 cubic meters gas capacity. A holder of a third class license may command airships of less than 6,000 cubic meters.

5. There are two aerial navigator licenses, elementary and superior. The presence of an elementary navigator is required by day on every public transportation aircraft making a trip of more than 200 and less than 500 km. over land, or a trip of less than 200 km. over water and such that the course, supposedly straight, does not carry the airship over 50 km. from the coast. By night the presence of an elementary navigator is required for every trip of less than 100 km. without leaving the country.

The presence of a navigator holding a superior license is required on any public transportation aircraft making voyages, by day or night, above land or water for distances greater than those mentioned above.

6. Only one form of license for mechanics employed on public transportation aircraft.

Candidates for the various licenses must undergo practical tests and pass technical examinations in accordance with a methodical plan and corresponding to the requirements of the aerial tasks which they propose to perform. Military pilots who have kept in practice may be excused from the flight tests.

With the exception of the license of touring pilot, licenses are only granted candidates, after satisfactorily passing a medical examination before a special board of physicians.

All licenses must be renewed every six months. In order to have his license renewed, the holder must submit to another medical examination. If he is an aeroplane pilot he must show by the record of his aerial services during the previous six months that he has lost none of the professional qualities required for the issuance of his license.

The interval of time during which the holder of a license must not have interrupted his aerial services is six months for aeroplane pilots, two years for airship pilots and five years for navigators.

Traffic Rules for Aircraft Regulation

We have just seen that an aircraft cannot be certified for flying without answering certain rigid requirements and that similar precautions are taken with regard to the crew.

To these fundamental conditions, which are mostly for increasing the safety of aviation, there have just been added rules for preventing collisions in flight, especially over and in the vicinity of airdromes.

The limits of this article do not allow us to explain in detail the measures adopted for this purpose. We will mention, how-

* From "Premier Congrès International de la Navigation Aérienne." Paris, November, 1921, Vol. I, pp. 165-170.

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ever, that these very complete regulations anticipate the maneuvers to be made by aircraft crossing or passing one another and landing or taking off simultaneously. They also provide for flight in the vicinity of and above airdromes: the direction aircraft must turn in response to signals and according to an established code; the interdiction of all acrobatic maneuvers and the division of the airdromes into landing and departing zones and a neutral zone.

These rules also prohibit flight over cities and towns, save at altitudes from which an aircraft can land outside the town, in case of failure of its means of propulsion.

For the purpose of being able to control the circulation of aircraft and identify them in case of infractions of traffic regulations, registration rules have been established. Every aircraft must be recorded in a special register and receive a registration certificate, on which are mentioned the distinguishing marks assigned to it, together with the name and address of its owner.

The registration marks, which consist of a letter indicating the nationality and a group of four letters, must be painted on the aircraft at designated locations and large enough to be ordinarily easily read by an observer on the ground.

Customs Regulations

In order to conform to customs laws, the following regulations have been adopted. Aircraft leaving the country can only depart from airdromes specially designated by the Customs Department of each country. Those coming from other countries must land on the same airdromes. Moreover, all aircraft flying from one country into another must cross the frontier between certain designated points.

The observation of these conditions enables the accomplishment of the customs formalities and the surveillance of the points of passage. Customs formalities on the designated airdromes comprise the verification of the freight, endorsement of manifest and route book and collection of customs duties.

Chance landings outside customs airdromes are provided for. If the commander of an aircraft, leaving a customs airdrome for a foreign country, lands before reaching the airdrome where he should accomplish the customs formalities, he must have his cargo verified by the nearest representative of the Customs Department. He may depart again only by authorization of this department, which, after verifying his books, designates the airdrome where the next landing is to be made for the purpose of paying the customs duties.

Safeguarding the National Defense

By the terms of the international convention the contracting countries having reserved the right to prohibit, for military reasons, flight over certain portions of their territory, each country has published special regulations on this subject.

France, who, by the decree of July 8, 1920, had anticipated the prohibition of flight over certain portions of her territory which she reserved the right to designate later, abrogated these dispositions by the decreee of June 10, 1921.

Private French aircraft and the aircraft of countries with which France has made agreements are therefore authorized to fly over all parts of the country, on condition that they observe the air traffic regulations given above.

Flight over certain zones is, however, forbidden all aircraft carrying photograph or kinetograph cameras.* Special authorization may be accorded French citizens to use photograph cameras over the forbidden zones, but this privilege cannot be extended to foreigners.

Outside the prohibited zones, any French subject may use photograph cameras without special permission. The same privilege may be accorded foreigners, but only after a request has been addressed, by the parties interested, to the "Service de la Navigation Aerienne" (Department of Aerial Navigation), and after inquiry of the department concerned (Department of the Interior or of Foreign Affairs), according to whether the foreigner resides in France or not. Permits for the use of photograph cameras by strangers are temporary and their validity cannot exceed one month.

The above brief exposition of aerial regulations now in force does not pretend to be exhaustive, but only a summary of legislation which is entirely new and of recent application.

This legislation, in harmony with the present resources and needs of aerial navigation, cannot be considered final and must be modified in the future according to conditions.

It may be affirmed that safety must depend on the strict application of such regulations and without safety there can be no great development of aerial navigation.

(Translated by the National Advisory Committee for Aeronautics.)

* (a) The part of France east of a line passing through the valley of the Meuse, the valley of the Moselle and the upper course of the Doubs as far as Switzerland.

(b) The six military ports of Cherbourg, Brest, Lorient, Rochefort, Toulon and Bizerte, as also Dunkerque, Nice, Villefranche and Bonifacio.

THE LARSON TENSIOMETER

IN aeroplane construction the minimum weight which is consistent with safety is essential. This requires that the stresses to which the parts of the structure are subjected be kept as low as possible. Some parts of the machine are subjected not only to the stresses imposed on them by the aerodynamic or flying load but also to internal stresses due to the tension in the stay and drift wires. A certain amount of tension in these wires is necessary to maintain the alignment of the machine. Any excess tension will increase the initial stresses in the structure and thereby either reduce the factor of safety or require a heavier construction. Cases are on record in which improper adjustment in the drift wires resulted in the failure of wing members. Also when two or more wires are used to carry a load it is important to know that each receives its share of the tension. Some method of accurately determining the tension in a wire or cable is therefore desirable and it is for this purpose that the Larson Tensiometer has been designed.

The tensiometer consists essentially of a frame about 10 inches in length with two supports, a fixed distance apart, between which the wire may be adjusted. (See photograph.) Midway between these supports and operated by hand levers is a plunger which deflects the wire from its normal position. The operation of deflecting the wire compresses a calibrated spring. A dial indicator, called the load dial, measures the compression of the spring, and this indicates the tension in the wire. A second dial indicates the deflection of the wire to the nearest 0.001 inch.

The theory upon which the instrument is based is simple. If a wire, under tensile stress, is deflected from a straight line a system of three concurrent forces, consisting of the tensions in the two segments of the wire on either side of the deflecting force and the lateral force, is formed. The system is in equilibrium and if the directions of all the forces and the magnitude of one are known the magnitude of the other two can be found.

In the operation of the instrument the wire is deflected a certain prescribed amount, hence the angles between the forces will be constant and the deflecting force will be proportional to the tension in the wire. The instrument is made direct reading by graduating the load dial so as to read the tension in the wire instead of the compression in the plunger spring. The sensitiveness of the instrument depends upon the sensitiveness of the load and deflection dials. Operating with a deflection of 0.1 inch, the deflection can be read directly to 0.001 inch, or 1 per cent. The load dial reads directly to the nearest 10 lbs.

To obtain the highest degree of accuracy on some of the larger sizes of wire the readings must be corrected for two reasons: (1) The tension in the wire is slightly increased when it is deflected from a straight line, (2) the wire offers a resistance to deflection because of its stiffness as a beam. Both of these tend to make the indicated load too large, but the corrections are of such a nature that they can be readily made when constant deflection is used.

The increase in stress due to deflecting the wire from a straight line depends upon the sectional area and the length of the wire, and upon the rigidity of the supports to which the wire is attached. Using the standard deflection, and assuming the supports to be rigid, it may be expressed by the formula

$$p = \frac{60{,}000}{L} A,$$ in which p is the increase in total load in pounds. A is the area of the wire in square inches and L is the length of the wire. It will be seen that this increase is small for conditions met in practice. Furthermore, this formula is based on the assumption that the ends are held in rigid supports. Any yielding of the structure to which the wire is attached will reduce the effect so that for aeroplane purposes this correction can generally be neglected.

The increase in the indicated load caused by the stiffness or beam action of the wire depends upon the amount of end restraint at the supports of the instrument and upon the section modulus of the wire. The end restraint depends upon the tensile

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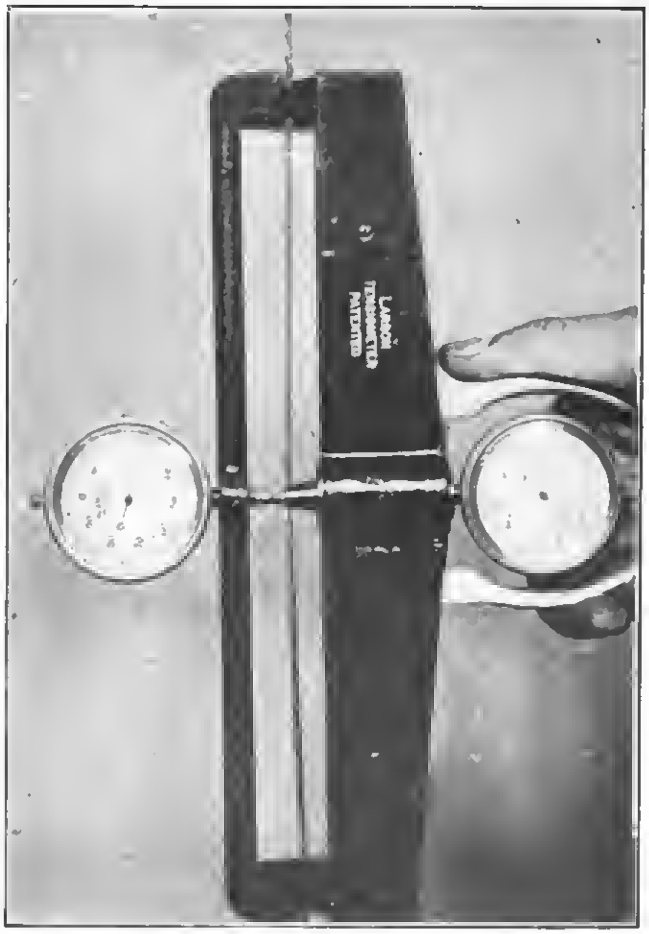
load on the wire. With no load the wire acts as a simple beam and as the tension on the wire increases the action approaches that of a fixed ended beam. The section modulus of the flexible cables is an uncertain factor, hence a theoretical consideration of this problem is impracticable. The only satisfactory method of determining the proper corrections is to calibrate the instrument on the various sizes of wire and cable upon which it is to be used. Calibration curves are available for most sizes of wire, both circular and streamline, and for all sizes of cable in use on aeroplanes.

As found from these curves the corrections for all cables up to 1/8 inch are negligible. For cables from 5/32 inch to 1/4 inch and for all sizes of round solid wires the corrections vary with the size of cable or wire, but not with the tension in the wire for loads above 200 lbs. For cables above 1/4 inch the corrections vary slightly with the load as well as with the diameter of the wire if the standard 10-inch instrument is used. A longer instrument on these large sizes of cable would materially reduce the corrections necessary.

Although corrections are required on a number of the sizes of wire and cable in use in aeroplanes the instruments can be made direct reading by setting the load dial for the correction of the size wire or cable upon which the observation is being made. The dial readings will then indicate the actual load on the wire near enough for all practical purposes. A plate giving the dial settings for the various sizes of wire is attached to the instrument.

The instruments have also been used in connection with sand loading test son planes and other research work. For such work in which greater accuracy is desired the calibration curves may be used to determine the load corresponding to any given reading.

In operation the instrument is never attached to the wire. It is simply placed in position, as shown in the photograph, and the hand levers brought together until the deflection dial makes one complete revolution (0.1). The reading on the load dial will then be the tension in the wire. When using the instrument on wires or cables for which corrections are required the load dial is adjusted by turning the face to the proper *zero* for the particular size of wire. The actual tension in the wire is then read on the load dial in the same manner as if no correction were needed. The time required to take a reading is only a few seconds, so that a complete set of readings on a plane may be taken in a very short time.



The Laraon Tenalometer

PROPOSED AIR TRAFFIC LAW

By PROF. GEORGES RIPERT,

Of the Paris College of Law and the School of Political Science[1]

SCIENTIFIC experiments and sporting activities have been followed by commercial exploitation. The important cities of Europe are connected by regular aerial navigation service. The "Indicateur Aerien" gives the time schedules, the transportation rates and the conditions for the acceptance of merchandise shipments. But when all these aircraft have left the ground, what law is going to control them, their crews and their passengers in this new domain which human intelligence has conquered?

Let us not imagine that, in overcoming the physical laws which seemed to hold him to the ground, man can thus easily evade juridical laws. The law of the country does not abandon him in these ethereal spaces, for every country has extended its frontiers to the sky and claims "complete and exclusive sovereignty over the atmospheric space above its territory.[2]

Moreover, the flights are of short duration and every time the aviator renews contact with the ground he returns to the juridical community which, for the moment, he may have thought he had left.

It is just because it cannot escape the law that aviation demands its due. It has today only an administrative set of regulations[3] and the subsidies accorded by the government[4] There is no aviation code of law.

It is a curious fact, however, that international law has here preceded the elaboration of internal law. An international convention signed October 13, 1919.[5] by the representatives of 32 countries "animated with the desire to aid the development of international aerial communications for peace purposes"[6] has established general rules relating to the nationality of aircraft and to the admission of aircraft over foreign territory. It created an international air traffic commission.[7] Annexes to the convention regulated air traffic in detail.

It would be very illogical, now there is an international convention, not to have an internal law. Hence, the government took the initiative on March 25, 1920, in introducing a bill on

[1] From "Premier Congrès International de la Navigation Aérienne," Paris, November, 1921, Vol. I, pp. 171-179.
This bill has been referred to the "Commission de la Société d'Etudes législatives" (Committee of the Society for Legislative Research), composed as follows: Mr. Fabry, counselor to the Court of Cassation, president; Messrs. Dufourmantelle, Imbrecq, Henri Fabry, Léon Jacob, Mantin, Pierrot, Rolland, Lumien, Talamon; Mr. Georges Ripert, chairman and Mr. René Capitant, secretary.

[2] International convention of October 13, 1919, for the regulation of aerial navigation, Art. 1: "The high contracting parties recognize that each power has complete and exclusive sovereignty over the atmospheric space above its own territory."

[3] Decree of July 8, 1920, regulating air traffic in France (Journal officiel, July 13, Bulletin de la Navigation Aérienne, No. 7). Decree of Aug. 14, 1920, fixing the conditions for the issuance of aircraft navigability certificates (Journal officiel, Aug. 14, Bulletin No. 6). Decree of April 14, 1920, establishing registration rules and the distinctive marks to be borne by aircraft (Journal officiel, Aug. 14, Bulletin No. 6). Bulletin of Aug. 26, 1920, regulating air traffic, beacons and signals (Journal officiel, Aug. 28, Bulletin No. 6). Decree of Sept. 18, 1920, relating to licenses of the navigating personnel of civil aeronautics (Journal officiel, Sept. 24, Bulletin No. 7). Decree of Sept. 30, 1920, establishing rules for keeping the books on aircraft (Journal officiel, Oct. 5, Bulletin No. 8). Decree of Jan. 12, 1921, establishing the customs rules to be observed by aircraft landing in or leaving France (Journal officiel, Jan. 18, Bulletin No. 11). Decree of June 10, 1921, regulating the transportation and use of photograph and kinetograph cameras on aircraft. Decree of June 10, 1921, repealing previous regulations relating to forbidden zones.

[4] Budget of April 30, 1921, Art. 88.

[5] The law of Jan. 29, 1921, authorized the ratification of the convention. It was completed by an additional protocol May 1, 1920, which was ratified July 15, 1921.

[6] Preamble of the convention.

[7] This commission was placed under the authority of the Society of Nations (Art. 34).

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air traffic.[8] It amended this bill by a second, designed to be incorporated in the first. This bill has been examined by the commission, but I cannot say that it was a satisfactory guide, since it was both incomplete and disconnected. Though rich in penal regulations, it is very incomplete in the civil code of aviation. It would appear to threaten more than encourage.[9] On the other hand, inspired by previous decrees, it has maintained the general progress of police regulation. This bill was, however, voted by the chamber of deputies on the recommendation of Mr. Bazire, in July, 1921. Foreign legislation does not yet offer any satisfactory model.[10] In most countries, the rules adopted are simple administrative measures relating to air traffic and chiefly copies of the measures of the international convention. The decree of the Swiss federal council of January 27, 1920, however, contains certain remarkable provisions.

It is therefore necessary to draw up (without the authority of tradition nor the example of a foreign law) a law suited to the new form of commercial exploitation. This is all the more difficult, because a good law must not only satisfy the requirements of the time, but also make suitable provision for the future development of aviation. When we search in the juridical world for laws which may serve us as a basis, we are immediately led to think of maritime law.

The words themselves suggest the comparison. The vehicle bears the name of aircraft and its flights are called aerial navigation. These words are no misnomers. Like the ship, the aircraft has an individuality and a nationality of its own. It carries with it a small colony of pilots and passengers. It constitutes the territory of a small community. The one who guides it must have special rights and duties. He is not only an officer, but also a chief. The aircraft, its crew, its passengers and freight run a common risk which may prove dangerous for them and others. All these conditions are the very ones which have created maritime laws.

There is, however, a difference, which cannot be disregarded. Sea and land are in some sort on the same plan and the ship never leaves its element. The aircraft flies above the ground and there are people and property on the ground. Thus there are two juridical worlds superposed. On the other hand, an aircraft returns to the ground and there becomes an inert or rolling vehicle. Instead of comparing it with a ship, would it not therefore be fairer to liken it to an automobile and subject it to terrestrial laws, since, after flight, it comes back to rest and renew its strength on the ground?

I do not think that such a conception could give aviation the law it requires. In my opinion, only a constant comparison with maritime law, with necessary modifications, can make it possible to state and solve the problems. Naturally, we must not expect to copy an aerial law from a maritime law, which has been elaborated by long centuries of work and which is enacted for a perfect system of navigation. But there was a time when maritime voyages were only made along the coast and when boats were pulled up on dry land after their return to port. At that time the whole maritime law consisted of but a few very simple rules. Such is the aircraft of today, which returns to earth after a short flight and such are the present aerial laws, taking into consideration the progress of juridicial science. Soon aircraft will remain in the air for days at a time and will make distant voyages. Then aerial laws will be improved and will presumably become more and more like maritime laws.

PART I.[12]

Aircraft

Chap. 1. General Provisions

Art. 1. The present law applies to all machines capable of lifting themselves or circulating in the air (Pr. Art. 2).

Art. 2. Military and government aircraft, exclusively assigned to public service, are only subject to the laws relating to the responsibility of the proprietor or the exploiter (Pr. Art. 2; Conv. Art. 30 and 31).

Art. 3. Every aircraft must be entered in a register, kept by the department in charge of the air service. It is distinguished by a name or number and by the designation of the class to which it belongs (Pr. Art. 3; Conv. Art. 10). A decree will designate the classes of aircraft which are not required to register (Pr. Art. 9).

Chap. 2. Nationality of Aircraft

Art. 4. An aircraft entered in the French register has the French nationality and must carry symbol of this nationality according to regulations (Pr. Art. 1 and 3; Conv. Art. 6 and 10).

Art. 5. No aircraft can be registered in France unless it belongs entirely to Frenchmen (Pr. Art. 2; Conv. 7, par. 1).

Only French companies can be registered as the proprietors of aircraft. Moreover, in partnerships, all the persons associated by name and all silent partners and, in stock companies, the president of the administrative council, the manager and at least two-thirds of the directors must be French (Pr. Art. 3; Conv. Art. 7, par. 2).

Art. 6. An aircraft registered in France loses its French nationality if the conditions of Art. 5 are not fulfilled or if its proprietor has it registered in a foreign country (Pr. Art. 3).

Art. 7. Any aircraft registered in a foreign country can be entered in the French register only after the erasure of its entry on the foreign register (Pr. Art. 3; Conv. Art. 8 and 9).

Art. 8. Aircraft of foreign nationality cannot fly over French territory unless the right is accorded them by a diplomatic convention or if they receive authorization, which must be special and temporary (Pr. Art. 1; Conv. Art. 5).

Art. 9. The commercial transportation of passengers and freight between different points on French territory and between France and the French colonies is reserved to French aircraft, with the privilege of according special and temporary concessions by decree (Conv. Art. 16 and 17).

Art. 10. The juridicial relations between passengers on a foreign aircraft in flight are governed by the law of the country of the aircraft, whenever such law is normally competent.

However, in the case of a crime committed on a foreign aircraft, French courts are competent, if the author or the victim is of French nationality, or if the aircraft lands in France after the commission of the crime (Conv. Art. 32 and 33).

Chap. 3. Ownership and Mortgaging of Aircraft

Art. 11. The register gives the name and address of the owner of the aircraft, the type of machine and its name or number.

Art. 12. Aircraft are personal property for the application of the laws of the civil code, but the cession of property must be confirmed in writing and only affects third parties by being entered in the register.

Every property transfer, by decrease or otherwise, must be recorded in the register at the request of the new proprietor.

Art. 13. Registrations are public property and any one may obtain a certified copy.

Art. 14. Aircraft may be mortgaged. The mortgage is recorded in the register. The law of July 5, 1917, on fluvial mortgages has been declared applicable to aircraft mortgages, the official who keeps the register being substituted for the registrar of the tribunal of commerce for this purpose.

Chap. 4. Seizure and Sale

Art. 15. The seizure and forced sale of an aircraft are made as provided by the law of July 5, 1917, on the registration and mortgaging of river boats, and the record of the proceedings is always entered in the register.

Art. 16. In case of seizure for infringement of a patent, the proprietor of the foreign aircraft, or his representative, may obtain a release on depositing a bond, the amount of which, in default of mutual agreement, is fixed with the least possible delay by the justice of the peace of the place of seizure (Pr. Art. 16; Conv. Art. 18).

Art. 17. When the proprietor of the aircraft is not domiciled in France, or when the aircraft is of foreign nationality, any creditor has the right to make a seizure with the authorization of the justice of the peace of the canton where the aircraft has landed. The judge may grant a withdrawal of the seizure, if the proprietor offers to deposit a bond equal to the amount of the indebtedness claimed, and he can order such withdrawal, on fixing the amount of the bond, in case of dispute over the amount of the debt (Pr. Art. 39).

Art. 18. The public authorities have the right to seize any French or foreign aircraft which does not fulfill the conditions provided by law, or of which the pilot has committed an infraction.

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[8] The articles of this bill are referred to by the abbreviation Pr. ("projet," bill).

[9] "The original characteristic of this bill," writes Deputy Bazire in his report, "resides especially in its being a collection of penalties, which enable quick repression of law infringements."

[10] *Great Britain.*—Law of March 1, 1919, which enabled the regulation of air traffic by decree.

Belgium.—Decree of Nov. 27, 1919, supplemented by a departmental decree adopting the regulations of the international convention.

Italy.—Decree of Nov. 27, 1919.

Spain.—Decree of Nov. 5, 1919, on air traffic; decree of April 27, 1920, on rules relating to pilots, observers and mechanics of the civil air service; decree of April 17, 1920, on foreign aviators in Spain; decree of March 6, 1920, on registration of aircraft.

Switzerland.—Decree of the federal council, Jan. 27, 1920, on air traffic regulation in Switzerland.

Holland.—Decree of Sept. 7, 1920, on air traffic.

Colombia.—Decree of March 15, 1920, on the regulation of aviation.

[11] Does it not thus come under fluvial law? In countries where fluvial law is important (Belgium, Holland, Germany), river and canal transportation are governed by maritime law or rules based on this law.

[12] The abbreviation "Pr." refers to the proposed law voted by the Chamber of Deputies; "Conv." to the convention of October 13, 1919.

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An aircraft can be confiscated only in cases provided by law (Pr. Art. 39).

PART II.

Air Traffic

Chap. 1. Right of Circulation

Art. 19. Aircraft may circulate freely above French territory, excepting for the reservations of Art. 8 (Conv. Art. 5).

However, the right for an aircraft to fly over property cannot be exercised under conditions such as to interfere with the rights of the proprietor.

Art. 20. Flight over certain portions of French territory may be prohibited by decree for military reasons. The location and extent of the forbidden zones must be definitely indicated by the decree.

Any aircraft which enters a forbidden zone is required, as soon as it becomes aware of the fact, to give the proper signal and land on the nearest airdrome outside the forbidden zone (Pr. Art. 10; Conv. Art. 3 and 4).

Art. 21. An aircraft may fly over a city or town only at such an altitude that it would always be possible to land outside the city or town or on a public airdrome, even if the engine should stop (Pr. Art. 20).

Art. 22. All acrobatic stunts, consisting of perilous and useless evolutions, are forbidden above cities or the part of an airdrome open to the public (Pr. Art. 20, par. 2).

Art. 23. Evolutions of aircraft for public exhibition can occur only with permission of the chief of police after consultation with the mayor.

If the test consists of a trip including several successive landings, the permission is given by the Minister of the Interior (Pr. Art. 19).

Chap. 2. Landing and Airdromes

Art. 24. Except in cases of urgent necessity, aircraft must land only on airdromes open to the public (Pr. Art. 4; Conv. Art. 24).

Art. 25. In case of landing on private property, the owner of the land cannot oppose the departure or removal of an aircraft the seizure of which has not been ordered.

Art. 26. An airdrome is any field specially prepared for the departure and landing of aircraft and designed to serve air traffic either in public or private capacity.

Art. 27. Public airdromes are created by the central government, the "departments" (counties) or the "communes" (townships).

Departmental or communal airdromes can only be established with the authorization of the minister in charge of the air service and they are subject to the surveillance of government agents (Pr. Art. 4; Conv. Art. 24).

Art. 28. Fields to be acquired for the establishment of public airdromes may be the object of a declaration of public utility by decrees rendered in the form of public administrative regulations (Pr. Art. 41).

Art. 29. An airdrome may be established by the owner of the field only by administrative permission.

The permit may specify that the airdrome must be open to all aircraft, in which case it will fix the rent to be paid the owner of the land. The permit may be withdrawn, if the conditions are not observed (Pr. Art. 4).

Art. 30. Aircraft which cover international routes must take off from and land on special airdromes, termed frontier airdromes. In crossing the frontier, they must follow a route determined by the administrative authority (Pr. Art. 14; Conv. Art. 15, par. 2).

Certain types of aircraft may, by reason of the nature of their work, be excused from landing on the frontier airdromes. The permit designates, in this case, the airdrome of arrival and departure, the route to be followed and the signals to be given on passing the frontier.

Chap. 3. Air Traffic Police

Art. 31. The commander, pilots, mechanics, and all other persons connected with the operation of an aircraft must have licenses under conditions determined by ministerial decree.

Licenses of commanders and pilots of French aircraft making international trips can only be granted to Frenchmen (Pr. Art. 8; Conv. Art. 12 and 13).

Art. 32. No aircraft can engage in air traffic unless it has been registered and is provided with a navigability certificate, issue after inspection of the machine, under conditions determined by ministerial decree.

The decree will further determine the pieces to be carried on the aircraft and the marks to be painted on it (Pr. Art. 6, 7 and 9; Conv. Art. 11, 19 and 20).

Art. 33. Without special authorization, aircraft are forbidden to carry explosives, arms and war munitions, homing pigeons and objects of correspondence comprised in the postal monopoly.

Transportation and use of photograph cameras may be forbidden by ministerial decree (Pr. Art. 11; Conv. Art. 26 to 29).

Art. 34. No radio instrument can be installed on an aircraft without special permission.

Aircraft assigned to a public passenger transportation company must be provided with radio instruments under conditions to be fixed by decree.

In every instance, men assigned to radio service must be provided with special licenses (Pr. Art. 12; Conv. 14).

Art. 35. Every aircraft, landing on an airdrome, is subject to inspection and surveillance by the administrative authorities (Pr. Art. 13; Conv. Art. 21).

Art. 36. Every aircraft in circulation, wherever it may be, must submit to the orders of the post office department and to the police and customs aircraft, under whatever form such orders may be given (Pr. Art. 13; Conv. Art. 15, par. 1).

Art. 37. Aircraft flying exclusively over airdromes and regions assigned by administrative authorities as experiment fields are not subject to the conditions required by law for air traffic.

They cannot, however, carry passengers, unless provided with navigability certificates (Pr. Art. 21).

Art. 38. Certificates of navigability and licenses, issued by the government whose nationality the aircraft possesses, are honored for flight above French territory, if the equivalent has been allowed by international convention or by decree.

PART III.

Air Traffic

Chap. 1. Transportation of Merchandise

Art. 39. A contract for carrying freight is confirmed by a way-bill or receipt. This document must contain, in addition to the stipulations of Art. 102 of the "Code de Commerce," the statement that the shipment is to go by air.

Art. 40. The carrier must fill out a manifest, designating the nature of the merchandise carried. A duplicate of the manifest must be carried on the aircraft and must be shown on demand to agents of the traffic police and to customs agents.

Art. 41. The carrier is responsible for loss or damage of goods carried, aside from acts of Providence or defects inherent in the goods.

If, however, the value of the goods is not declared by the shipper, the responsibility of the carrier is limited to 1000 francs for each package.

Art. 42. The carrier may, by special clause, free himself from the responsibility otherwise devolving on him by reason of the risks of the air and of errors committed by the crew.

This clause relieves the carrier of responsibility only on condition that the aircraft is in good navigable condition on starting. The administrative certificate carries a presumption of navigability, which may, however, be overthrown by proof to the contrary.

Art. 43. All clauses are null, whose object is to relieve the carrier of responsibility for himself or his subordinates, in loading, storing and delivering goods.

Art. 44. The commander has the right to have the merchandise thrown overboard during the trip if it is necessary for the safety of the aircraft. If a choice is possible, he must throw overboard merchandise of small value. No responsibility devolves on the carrier, toward the shipper and addressee, for this loss.

Art. 45. With the preceding exceptions, the rules of the "Code de Commerce" relating to transportation by land and water apply to transportation by air.

Chap. 2. Passengers

Art. 46. The contract for carrying a passenger must be confirmed by the issuance of a ticket.

A list is made of the names of the passengers, a duplicate of which must be kept on the aircraft and communicated on demand to agents of the traffic police.

This does not apply, however, to round non-stop flights back to the airdrome of departure.

Art. 47. For international transportation, the carrier can only accept passengers, after making sure that they are regularly authorized to land at the point of destination or intermediate stations.

Art. 48. The carrier may relieve himself of responsibility for accidents to the passengers in accordance with the provisions of Art. 42.

Chap. 3. Renting Aircraft

Art. 49. In case an aircraft is rented for several successive trips and for a given period of time, the commander, pilot and crew remain, except on agreement to the contrary, under the orders of the owner of the aircraft.

Art. 50. The owner of an aircraft let to a third party re-

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mains subject to the legal requirements and is held responsible, together with the renter, for their violation.

However, if the renting contract is recorded in the register and if the renter fulfills the required conditions for French aircraft, he is alone held responsible for fulfilling the legal obligations.

PART IV.

Responsibility for Damages

Art. 51. Pilots are expected to conform to the regulations with reference to the air traffic police, to the route, to the lights and signals and to take all necessary precautions for avoiding accidents.

Art. 52. In case of damage done by an aircraft in flight to another aircraft in flight, the responsibility of the pilots and of the owner of the aircraft is regulated in conformity with the provisions of the civil code (Pr. Art. 5, par. 2).

Art. 53. The owner of an aircraft is responsible for damages caused by the evolutions of an aircraft, or by objects becoming detached from it, to persons or property on the ground.

This responsibility can be escaped only by proving the fault of the victim (Pr. Art. 5).

Art. 54. It is forbidden to throw from an aircraft in flight except for urgent reasons, any objects whatsoever, with the exception of the regular ballast (Pr. Art. 15, par. 2).

In case objects or the regular ballast, thrown out by necessity, cause injury to persons and property on the ground, the responsibility will be regulated in accordance with the provisions of the foregoing article (Suisse, Art. 22).

Art. 55. In the case of a rented aircraft, the owner and the renter are jointly responsible toward third parties for damages inflicted (Suisse, Art. 26).

However, if the renting is recorded in the register, the owner is responsible, if the third party proves fault on his part.

Art. 56. The suit for damages may be brought, at the option of the plaintiff, either before the court of the town where the damage is done, or before the court of the town where the defendant resides.

If it is an injury done an aircraft in flight, the court of the place of injury is the one within the jurisdiction of which the victim is obliged to land after the injury (Suisse, Art. 32).

Art. 57. The law of April 29, 1916, on martime assistance and salvage applies to aircraft in peril at sea and to the pilots of aircraft who can lend assistance to persons in peril (Pr. Art. 17 and 18; Conv. Art. 22 and 23).

Art. 58. Any one who finds the wreck of an aircraft must report it to the municipal authorities within 48 hours of its discovery. Any infraction of this requirement is subject to the penalties in Art. 475, par. 12, of the penal code (Pr. Art. 18).

The rules regarding maritime wrecks apply only to aircraft found on the sea or seacoast (Conv. Art. 23).

Art. 59. In case of the disapearance of an aircraft without news, it is considered lost three months after the date of the dispatch of the last news.

The death of the persons on an aircraft may, after the expiration of this period, be declared by the application of the law of January 8, 1893.

PART V.

Penalties

(Under this head, there will be inserted the penal provisions in the legislative bill drawn up by the government.)

(Translated by the National Advisory Committee for Aeronautics.)

AIR SERVICE IN COMBAT IN CONJUNCTION WITH OTHER ARMS

By MAJOR H. H. ARNOLD,

Corps Area Air Officer

(Speech Delivered at meeting of the Association of the Army of the United States, May 22, 1922).

IN delivering this talk today two thoughts primarily impress themselves on my mind. The first is that I was told by one of the officers of this organization that in order to make an acceptable address I had not only to talk as if I were convinced that the Air Service was the most important branch of the Army, but also to convince everyone else of the same thing; and, second, that there was probably no other branch of the Army so freely "cussed out" during the World War as was the Air Service. In order that you may obtain the background for the picture of Air Service in combat it is essential that I digress for a few minutes from that subject and outline in a very general way the fundamental preliminaries which must be gone through to properly prepare for an efficient all-around combatant Air Service.

The structure around which any Air Service Unit is built is the Pilot. The success or failure of any mission, either in peace or war, in the Air Service depends upon the resourcefulness, stick-to-it-iveness, fearlessness and self-confidence of the pilot. In selecting personnel suitable for pilot training there are certain fundamental qualities which if it is known that an individual possesses make him immediately eligible for training without question. These qualifications may be outlined as: initiative combined with daring; willingness to sacrifice for military good; confidence, capacity for sustained suspense; interest, and perfect health. During the World War the average life of a pilot on the front was about three months. At the end of that time he had either been shot down, injured in a crash behind our own lines, or had developed nerves to such an extent that he imagined moderate difficulties and obstacles so as to make him unfit for further service. It is true that certain pilots last much longer than three months, but they were the exception rather than the rule.

The training of all Air Service personnel was conducted with a view of taking complete advantage of the qualities already outlined and utilizing to the fullest extent the short life of these men while they were on the front. Candidates for the Air Service were selected after having been given a thorough physical examination including a re-breather test. This test made it possible to determine at the start whether or not the candidates could control their entire physical and mental faculties at altitudes above 15,000 feet. Having been given this preliminary examination they were sent to a primary flying school where they were taught the fundamentals of flying, and—from actual observation segregated into groups according to their personal qualifications. These groups were: The very best pilots—*Pursuit;* extremely reckless but good gunnery—*Ground Attack;* calm, mathematical and exceptional concentration—*Artillery Observation;* exceptional knowledge of maps, distances and map reading *Photography;* exceptional vision, good in map reading and above average in gunnery—*Deep Reconnaissance.* The preliminary training of all pilots included fundamentals of radio, photography, attack, bombardment and gunnery. After they had been classified for special work they were given comprehensive courses in the subjects most necessary for their particular branch of flying.

The primary duty of any Air Service in battle is to clear the skies of all enemy air service,—this includes all hostile Lighter- and Heavier-than-air craft. The other duties, such as reconnaissance of artillery fire, bombardment and ground attack are all of secondary importance, for it is readily seen that if the enemy air service is permitted to observe for their own artillery, bombard masses of troops, supply stations, ammunition dumps, etc., photograph at will behind our lines and harass our own Infantry by ground attack, any work of a similar nature done by our own Air Service would be completely counterbalanced and no practical benefit would be derived therefrom. The statement so often made by officers and enlisted men in the other branches during the World War was that while they saw many German aeroplanes they seldom, if ever, saw any Allied planes in their section of the line. Further, apparently our own troops did not recognize our own planes when they saw them, for our own Infantry in the front lines quite frequently fired on Allied planes. It was, therefore, necessery, in order to keep our troops from firing at Allied aeroplanes, to post signs in conspicuous places where all troops could see them with the insignia used by our own Air Service on these signs, together with a request: "Do not shoot at aeroplanes using this insignia for they are your friends and are trying to help you." At about the time our own troops were making statements of never seeing Allied planes, the German troops were stating just the opposite. Shortly after the Armistice a German Artillery Officer was interviewed in Metz and he asked the question as to where the Allies secured all their aeroplanes, because while he was up on

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the front he saw many Allied aeroplanes but seldom, if ever, saw a German aeroplane.

In figuring out a plan of operation which will preclude the crossing of our own lines by enemy aeroplanes it has always to be borne in mind that Air travel is entirely different from ground travel in that aircraft can operate in three dimensions. There are no set roads to follow; they move so rapidly that they are seen only for a short time before they are actually present; they can change their course at will, making it impossible, as a general rule, to anticipate their destination. It is obviously impossible to have a constant patrol of combat aeroplanes along the entire front so dense that it will prohibit the crossing of hostile planes,—for while the patrols are operating from the ground to altitudes of 3000 feet, enemy planes could get over at five, ten or fifteen thousand. The enormous number of planes to be used in such a patrol to make it absolutely impenetrable would be entirely too great for the benefits which would be derived therefrom. However, in order that protection against hostile aircraft raids can be given, the generally accepted plan of operations is to have patrols over certain areas carried out at intervals,—the remainder of the combat Air Service to be held in readiness at the aerodromes. The presence of hostile aircraft is made known by calls from the ground troops; by anti-aircraft fire; by report from balloons or by actual observation of the pursuit planes on patrol. After their location is actually determined by one of the above methods a concentration of our own combat planes is made with a view of driving them down or back across the lines. These hostile planes might be crossing the lines for the purpose of carrying out any one of several missions, such as observing for artillery; taking photographs, bombarding ammunition dumps, supply stations or masses of troops, or harassing the Infantry. In any one of these cases, however, the method of defense is the same. After the hostile planes are located our own pursuit planes converge on that sector in such a manner as to insure that enemy's mission will not be executed.

One of the most disagreeable tasks in connection with protection against hostile aircraft is night pursuit work. This requires pursuit planes to leave their aerodrome in the dark with a view of locating hostile bombardment planes which might or might not have been located by searchlights and drive them down before they execute their missions. In order to properly perform this duty these pilots must have absolute confidence in their planes and must not know the meaning of the word "fear", for after once leaving their own aerodromes they are entirely dependent upon the reliability of their engines. Emergency landing fields cannot be seen at night and the pilot's only salvation is in his being able to return to a friendly aerodrome and by giving the Very pistol signal already agreed upon have the landing lights turned on the field prior to his actual descent.

In actual combat in the air there are certain well-defined rules which must be carried out in order to insure success in an engagement. Every aeroplane has what is known as a "blind spot". This is caused by parts of the aeroplane masking the pilot's or observer's vision. There are certain other sections in which an object can be seen but cannot be fired upon from the aeroplane due to interference by parts of the plane itself. An experienced aviator knows as soon as a hostile aircraft is seen where the blind spots are and the best method of attack. In order to eliminate these blind spots patrols ordinarily fly in a "V" formation. This enables the blind spots of one aeroplane to be covered by the guns from the other planes, and as long as the formation is kept intact any attacking force will be under fire at all times. The tactics of the air, therefore, contemplate maneuvers so that the formation will be broken,—usually by the least experienced pilots who get nervous or panic-stricken. As soon as the formation is broken it is an easy matter for the experienced pilots to approach the individual planes either by a straight dive from above or by a zoom under the tail and secure several machine gun bursts on the plane before being seen. The melee which ensues after a formation is broken was commonly called during the World War a "dog fight". Many an inexperienced pilot lost his life on account of his leaving the formation through fear, becoming rattled or due to mechanical trouble with his plane.

One of the first things a pilot learns in combat is that if he gets between the sun and his opponents he can attack almost at will. Another favorite method of attack is to have a decoy of one lone plane cruising around below a mass of clouds, and when hostile planes picked on it as something easy a whole formation comes out from in back of the bank of clouds and converges on the assailants.

The most important function of the Air Service in conjunction with the other arms is the securing and transmitting of information concerning the developments in and beyond the line of battle. This work has been in the past rendered most difficult because the limitations and possibilities of the Air Service were not sufficiently well known to the staff or to the troops, and the unreliability of the radio. The work of keeping the command informed is done by visual reconnaissance and reporting by radio, such as in artillery observation and by photographic missions. An aeroplane cannot stand still to observe and troops on the ground cannot be compelled, if they are hidden, to expose themselves; although in many instances a low-flying aeroplane by circling over a point suspected to conceal hostile troops has made them reveal themselves either due to their curiosity or their fear of bombardment or being shot at. A reconnaissance mission may sometimes fail, due to weather conditions such as fog or low clouds. In this connection an incident which occurred in the Argonne is to be noted. One of our crack pilots took up a brand new Observer. As he was about to cross the line he noticed that the "Archies" opened up with unusual intensity and that beyond the lines there was a low bank of clouds. After very skillful dodging he penetrated the barrage of "Archies" and flew low through the clouds to his objective. The pilot saw conditions which made him anxious to return with the news,—so that after a very hazardous flight he returned over the waiting General who was to receive the report, and the Observer dropped the message. After landing at the airdrome the pilot asked the Observer: "What message did you drop?" The Observer replied: "I dropped him this message: Would liked to have gone over the lines and completed the mission but there were too many Archies."

To the experienced aerial observer certain things show up on the ground more or less clearly due to the background and shadows. Soldiers standing on the line where two fields meet are hard to see, while if they are a few feet away from the line they become readily visible. Wheel tracks and paths are easily noted. Freshly turned earth is very conspicuous and no amount of camouflage can completely conceal it. To locate troops on broken ground requires flying at altitudes of seven hundred feet or less at which altitude aeroplanes are extremely vulnerable to machine gun fire from the ground. A mission which is often given to the Air Service is to locate the advance line of the Infantry. This mission is most difficult to perform as a general rule on account of the Infantry being too busy or their having no inclination to show their panels. Then, on the other hand, there is a certain fear that if they do show their panels they are locating their position to hostile aircraft. During the World War a certain Infantry Regiment on the front line was visited by an Air Service Officer, and when the command plane which was sent out to locate their front line had fired off the predetermined signals which established its identity, the infantry battalion did not display its panels. The Air Service Officer asked why the panels were not displayed and he was told that they would not display their panels for any aeroplanes because as soon as they did a Bosch plane would see the panels and in a few minutes all the hardware in Germany would be rained upon them. However, the aeroplane can, with the co-operation of the front line Infantry, establish for the Commanding General the exact location of the front line troops more accurately than can be done in any other way.

Aerial photographs, if taken under proper conditions, will show the minutest details of the ground. In order to properly interpret them, however, considerable experience must be had in that line of work, otherwise data of the utmost importance will be seen but not appreciated. When the air is clear and there is no haze, the taking of aerial photographs is simple, but with unfavorable weather conditions and artificial hindrance such as smoke considerable difficulty is experienced in securing the results desired. When the Commanding General of troops desires information concerning the area back of the enemy's lines he cannot wait for the clouds to clear or the smoke to blow away. To remedy these cond tions certain improvements have been made on cameras which make it possible now to take fairly clear and distinct pictures in spite of haze and smoke. Under ideal conditions it is now possible for an aeroplane to leave its airdrome, fly fifty miles, take a photograph or a series of photographs, return with them to the airdrome, develop the films and print the pictures and have them in the hands of the staff requiring them,—all within one hour and forty minutes.

Artillery observation is most satisfactorily performed by aeroplanes making figure eights over the objective and sending in to the artillery command station the results of the firing by radio. That would be the ideal way of carrying it out provided the enemy did not have the habit of trying to drive the planes home while they were at work. For the shorter ranges the best observation is performed by the captive balloons. These Balloons ascend to altitudes of about 3000 feet and practically are nothing more or less than an elevated platform 3000 feet above the ground. From this point, by the use of field glasses, they can spot every shot fired and its relation to the target. As the range increases it becomes necessary to send artillery observation planes over to report on the results of the firing regardless of hostile interference. In some instances, provided the results expected warrant it, it may be necessary to use Pursuit planes to protect the Observation planes while they are on that mission; but ordinarily the observation planes must be self-sup-

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porting. While the Observer is locating the shells which fall the pilot must guide his ship so that the target is always under constant observation by the Observer and at the same time the pilot and observer both must keep on the lookout for the attack of hostile planes. A few other special missions which observation aeroplanes carry out are finding the enemy's lines; reporting location of and relaying signals from our own front line infantry; repeating instructions to our advance lines; indicating where resistance to advance will be met; using at critical moments the guns and bombs mounted on the aeroplanes against points of resistance and verifying reports received which are thought to be of value.

The principal Air Service offensive operations against ground targets are bombardment and ground attack. Points most usuallly designated for bombardment objectives are; ammunition dumps, railroad stations, cantonments or masses of troops, storage areas within the fighting area, and manufacturing plants, railroad stations and large supply stations beyond the fighting zone. Unless they are of such large size as warrant special attention these objectives within the fighting zone are usually bombarded by the day bombardment aeroplanes and those objectives beyond the fighting zone are usually bombarded by the night bombardment planes. The main difference between the day bombardment and the night bombardment planes is the radius of action and load carried; whereas, the day bombardment planes have a radius of action of about 300 miles, the night bomhardment planes have a radius of action of from six to eight hundred miles. The day bombardment planes can carry a load of three or four hundred pounds of bombs and the night bombardment planes can carry a load of bombs up to two thousand pounds. The day bombardment planes are able to go over the lines at an altitude of from eight to twelve thousand feet, while the night bombardment planes go over the lines as low as fifteen hundred feet.

Ordinarily the day bombardment planes rely on the "V" formation for their safety. In certain instances where enemy aircraft are known to be in extra heavy force Pursuit planes are sent along as a convoy until they have passed the front line of the enemy's airdromes. In order to make their report complete after return to their home airdrome in the majority of day bombardment raids one plane is equipped with a camera and takes pictures of the objective together with its appearance before and after the bombs have been dropped. During the War, usually either while the bombs were being dropped or after they had been dropped the bombing forces would be attacked by enemy planes and would be forced to fight its way home. The night bombardment planes rely principally upon darkness for their protection. They fly at low altitudes, make their attack and then usually return by another route so that they will not he intercepted as they cross the lines.

During the War the Air Service while engaged in infantry missions learned from experience that it could cause much consternation amongst hostile ground troops hy flying low and dropping small 15-lb. hombs among groups of men or light artillery, and in some cases by actual machine gunning troops in the trenches or assembled in a mass along roads or other places. The actual physical results of these ground attacks were probably not very great, but there is no question as to the effect on the morale of the troops. In several instances during the German retreat aeroplanes were so fortunate as to see portions of roads crowded with convoys and masses of troops and were able to fly down on them and drop a few bomhs and then turn and come back sweeping the road with machine gun fire before the surprised columns could take cover or scatter.

This class of work necessitated the design and construction of a special type of aeroplane called the "Ground Attack" plane. The sole purpose of this plane in combat is low flying over the lines engaging with its machine guns such hostile forces as present a favorable target. This machine has mounted in it a 37 mm. gun which can attack tanks with an assurance that if it makes a hit the tank will probably be put out of commission. In the design of this plane armor plate is incorporated to such an extent that the engine, radiator, gas tanks and personnel are completely covered and safe from small calibre guns. This pract.cally insures the safety of the plane and its personnel while ti is flying over the line.

In the St. Mihiel offensive the Air Service was called upon to perform more continous and harder flying than in any other offensive. The plan of operations as outlined for them neccessitated the utilization of not only the entire American Air Service available but attaching to it a certain number of French and British Air Service Units. Our first Army in that operation was composed of the 1st, 4th and 5th American Corps and the French 2nd Colonial Corps. Each Corps had assigned to it an Observation Group which was a component part of that corps and under the direct orders of the Corps Commander. Observation Group for duty with the Army was formed for taking care of all long-range day reconnaissance. Another Observation Group was used for regulating the Army Artillery. In addition to this there were quite a fw bombing squadrons and sveral pursuit groups. The total aeroplanes used in this operation were: 701 Pursuit planes; 366 Observation planes; 323 Day Bombardment Planes and 91 Night Bombardment planes, a total of 1481 planes which was the largest Air Service force that had ever been engaged in one operation any time during the progress of the war. In spite of the fact that during the first three days of the operation the weather was bad, command, observation, surveillance and infantry attack planes all accomplished their missions. However, on one day only was it possible to send out photographic missions. The Observation planes penetrated as far as sixty kilometers beyond the enemy's front line at a time when rain was falling heavily and clouds prevented flying at an altitude above 3000 feet.

There were also under the command of the Commanding General, 1st Army, fifteen American and six French Balloon Companies. There were approximately twelve enemy balloons opposite the American Sector. The American Balloon Companies moved forward with the advancing line and on the third day of the offensive were sufficiently well-posted to regulate artillery fire and send in additional important information to Corps and Divisional Staffs. During the four days of the offensive the twenty-one balloon companies had moved forward a total distance of Two Hundred Two Kilometers. Despite handicaps of weather, etc. the Air Service contributed materially to the success of the St. Mihiel operations. The Staff was kept informed practically hourly by clear and intelligent reports; hostile air forces wee beaten back whenever they were encountered; rear areas were watched, photographed and bombed.

Here is what the Air Service did in the last war. It located our own front line and hostile line for the Commanding Generals; took photographs of the terrain in back of the enemy's line for the General Staff; observed and reported on shots fired for the Artillery; bombed and raked with machine gun fire hostile machine gun nests, and points of resistance for the Infantry; carried important personages and supplies for the Quartermaster Corps; made strategic reconnaisances for the Cavalry and messages for the Signal Corps; in especially constructed ambulance planes carried wounded needing immediate attention for the Medical Corps—and in the great battle of Paris the young pilots put on the dog—for the whole Army.

AIR TRAFFIC

By G. SUDRE

HARDLY had aviation emerged from the experimental stage before France began to think of the improvement in international relations which should accrue from the conquest of the air. Nothing could better demonstrate this desire for general harmony than the attempt made in 1910 by the French government to conclude an international aerial convention.

This project, not meeting everywhere the same concurrence, was abandoned. It was renewed, this time with success, when the considerable development of aerial navigation during the war of 1914-18 necessitated, at the close of hostilities, the solution of a series of questions, which had yet hardly been touched.

As regards air traffic, it was necessary to establish general principles, according to which aircraft could circulate in their own country and pass from one country to another.

National Legislation

This was the task undertaken by the convention for regulating air navigation, which was signed October 13, 1919, by the representatives of 27 governments. The exchange of ratification of this convention was delayed by the fact that the United States and Canada formulated certain reservations which had to be examined.

On the other hand, a certain number of neutral countries requested, before giving their adhesion to this convention, that another protocol be added permitting, under certain conditions, derogations of article 5 of the convention of October 13, 1919, an article which obliged the contracting countries to forbid the circulation, above their territory, of the aircraft of non-contracting governments.

While awaiting the ratification of the convention, provisional

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agreements were made, on the basis of the principles contained in it, between France and England, France and Switzerland, and are now being arranged between France, Holland and Spain. A *modus vivendi* has been established on the same principles between France and Belgium.

The work accomplished by the convention of October 13, 1919, was considerable, since it established the general principles and the scope of international aerial legislation and has consequently determined the interior legislation, which must harmonize with the clauses of this general "chart of the air."

The importance of this document necessitates a brief summary. After establishing a few principles of a general nature, the convention enunciates, in chapters I, II and III, the rules to follow regarding the nationality of aircraft, certificates of navigability and certificates of fitness of pilots. Chapter IV is devoted to air navigation over a foreign country, and chapter V to the rules to be observed in starting, en route and in landing. Chapted VI treats of forbidden shipments (explosives, arms, ammunition, etc.) and chapter VII of government aircraft. Lastly, chapter VIII institutes a permanent body, the "International Commission of Aerial Navigation," which is "placed under the authority of the Society of Nations." This introduces a principle of a more general order than that of most international agreements, which are simple compromises between various and often conflicting national interests. The convention of October, 1919, was thus an attempt to realize an aerial society of nations.

The convention of 1919 having established international bases for national legislation, the French Government was enabled to resume its project of May 7, 1913, which had been abandoned after the failure of the proposed international convention of 1910.

A new legislative bill, signed by the ministers of Foreign Affairs, Public Works, Interior, War, Navy and Finance was deposited March 25, 1920, on the desk of the Chamber of Deputies.

The principles laid down in the convention of 1919 were faithfully followed and the consequences deduced. The rules adopted before the war by the decree of December 16, 1913, and which inspired the legislative bill of the same year, were adapted to the new circumstances and conditions of aviation. This bill, after various amendments, was adopted by the Chamber of Deputies and is now before the Senate.

On the other hand, while awaiting the action of Parliament, there was urgent need of harmonizing the French interior regulations, contained in a decree of December 16, 1913, with the new exigencies of aerial locomotion, as well as with the international agreements already made.

French Interior Regulations

The decree of July 8, 1920, responded to this need and laid down the general principles of aerial navigation in France. It left the details of regulation to a series of orders which appeared during the past year. These documents now constitute the French code of the air. A brief enumeration of the principal ones will sufficiently indicate the breadth and complexity of the problems studied, as well as the very advanced degree of organization already attained by air traffic in France.

Decree of August 9, 1920, regulating the employment of radio for protecting the flight of aircraft (Journal Officiel, September 2, 1920; *Bulletin de la Navigation Aerienne*, No. 7, October, 1920).

Decree of August 14, 1920, establishing the conditions for the issuance of certificates of navigability for aircraft (*Journal Officiel*, August 14, 1920; Bulletin No. 6, September, 1920).

Decree of August 14, 1920, fixing the registration rules for aircraft and the distinctive marks to be borne by them (*Journal Officiel*, August 14, 1920; Bulletin No. 6, September, 1920).

Decree of August 26, 1920, regulating air travel, beacons and signals (*Journal Officiel*, August 29, 1920; Bulletin No. 6, September, 1920).

Decree of September 18, 1920, relating to licenses for civilian pilots (*Journal Officiel*, September 24, 1920; Bulletin No. 7, October, 1920).

Decree of September 30, 1920, establishing the rules to follow in keeping books on aircraft (*Journal Officiel*, October 5, 1920; Bulletin No. 8, November, 1920).

Decree of January 12, 1921, establishing the customs regulations to be observed by aircraft landing in or leaving France (*Journal Officiel*, January 18, 1921; Bulletin No. 11, February, 1921).

Decree of June 10, 1921, regulating the transportation and use of photograph and kinetagraph cameras on aircraft (*Journal Officiel*, June 23, 1921).

Decree of June 10, 1921, abrogating previous dispositions relating to zones forbidden to aerial navigation (*Journal Officiel*, June 23, 1921).

Decree of August 23, 1921, doing away with the medical examination for the license of the pilot of a touring aeroplane (*Journal Officiel*, August 25, 1921).

Inspection of Aircraft and Pilots

Lastly, a certain number of departmental documents have determined the application of these decrees, as regards the supervision to be exercised over the pilot and aircraft, as well from the professional and technical point of view, as from the physical and material.

Thus the instructions of August 31, 1920, fixed the technical conditions to be fulfilled by aircraft for the obtention of navigability certificates. The instructions of September 18 and 28, 1920, fixed the professional and medical conditions to be fulfilled for the issuance, use and renewal of the licenses of civilian air pilots.

The above-mentioned decrees appeared in the *Journal Officiel* of the French Republic. All the supplemental instructions were published in the *Bulletin Officiel de la Navigation Aerienne.* These documents together give to aerial navigation the administrative regulations, in accordance with which it is expected to develop normally.

It was evidently necessary to regulate and coordinate carefully all improvements in aviation,, in their various manifestations, in order to avoid, in this branch of the industry which represents both mobility and speed any scattering of energy and anarchic incoherence and the consequent sterility of efforts and arrest of progress.

It must not, however, be forgotten that any regulation is beneficial only in so far as it is limited to the efficacious and discreet role of the internal framework, the invisible and robust skeleton of a living organism. It is a common characteristic of all fond and anxious mothers to fear all outside contact for their young children, and the French government, which, it must be confessed, is bending over the new-born Aviation with a passionate solicitude, has not been able to escape it entirely. It is thus that, as regards the customs regulations, the obligations of the technical supervision of the material and the conditions of the medical or professional examinations, certain requirements could be ameliorated without any real disadvantage. May the professional "regulator" be permitted to utter a vow not to regulate matters of the air with excessive prudence. In such matters the regulations of today are liable to become a dead weight by tomorrow, and weight is the enemy of the aeroplane.

Statistics

The development of air traffic is followed and confirmed by a monthly statement of the traffic of the French air lines in operation and a monthly report of accidents for each aerial navigation company. These statistics cover, for each line, the number of

(a) Trips scheduled, trips completed and trips partially completed;
(b) Kilometers flown;
(c) Paying passengers,
Non-paying passengers;
(d) Kg. of freight carried;
(e) Kg. of mail carried;
(f) Fatal accidents,
Accidents causing injuries,
Accidents causing only material damages.

From January 1 to September 15, 1921, the statistics for the French aerial navigation companies are:

1,617,119 km. flown;
8,068 passengers and 112,621 kg. freight and mail carried;
4 fatal accidents;
8 accidents causing injuries only.

Insurance

The matter of insurance in aerial navigation at present leaves much to be desired.

Since November 1, 1919, the French companies have combined in a "consortium" for carrying aerial transportation risks. The premiums in force are, unfortunately, high, the companies desiring to protect themselves amply, in new forms of insurance, against risks little known as yet. In fact, up to the present time statistics have pertained chiefly to war risks. The mean risk of commercial aviation can only be determined after about two years of general and carefully collected statistics. We have seen that such statistics have already been kept for several months.

Insurance rates will be greatly reduced when the "Bureau Veritas" completes the task it has undertaken of establishing an aeroplane register similar to that of the English Lloyd for ships.

(Translated by the National Advisory Committee for Aeronautics)

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NAVAL and MILITARY AERONAUTICS

General Mitchell in Accident

Milwaukee.—Brigadier General William Mitchell suffered a fracture of three ribs as a result of being thrown from a horse May 28, when physicians made a diagnosis of his injuries. General Mitchell is at the home of his sister, Mrs. Arthur Young, here and will be confined to his bed for several days, it was said.

Training Operations Started at Ellington Field

Training operations, in which every qualified pilot of Ellington Field will participate, began on May 1st. The first week's schedule consisted of tactical formation training by squadrons of full strength. Pilots have been assigned in equal numbers to the 94th and 27th Squadrons.

Activities of the Trade Test Department at Chanute Field

Statistical reports show that during the period between December, 1919, and July, 1921, approximately 1450 students were placed in the Air Service Mechanics School, Chanute Field, for courses of instruction. Of this number 2.2 per cent were dropped for inaptitude, having failed to make the grade of 70 per cent or above. Prior to December, 1919, 32 per cent of the men entered in school were dropped via the inaptitude route, thus showing that the Trade Test Department has been successful in reducing the failures of the school by nearly 30 per cent. Statistics further show that during the functioning period of the Trade Test, approximately 100 men were rejected as being incapable of assimilating any course of instruction taught at the school, thereby effecting a great saving of money, in addition to upholding the morale of the various classes to a marked degree, inasmuch as a man of mediocre intelligence or a slow thinker would impede the necessary rapid progress which students must make.

The immense amount of time and energy expended in the placing of these men in courses which will prove most heneficial to the Air Service and to themselves is not shown in these figures. A conservative estimate of the number of interviews granted, by which the Trade Test Department has attained its enviable record, would reach close onto the five thousand mark, since it is found necessary in fifty per cent of the cases to change the men from their natural desires to a course best fitting their qualifications. The "Natural Desire" is usually the course for Airplane Mechanics or Airplane Engine Mechanics. In placing a man in a course of instruction, three important considerations must be dealt with, paramount among which being the existing orders from the Chief of Air Service that 22 courses of instruction be maintained and in constant operation; secondly, the man's qualifications; and thirdly, the man's desires. The orders from the Chief of Air Service require that a certain proportion of the students of this school be placed in each of the 22 courses which are taught, in order that each course may be operating at its full capacity at all times. This is necessary in order to supply the organizations with specialists in the wide and varied trades necessary to properly carry on Air Service work. To meet this condition, men sent to this school for instruction must in many cases be placed in courses which at the outset they do not desire. It can readily be seen that if these men were simply ordered to take a course and placed in that course without further notice, a great loss of efficiency would result, for while a man can be placed in a course of instruction he cannot be forced to learn nor to take an interest in his work. Men would be dissatisfied and the morale of the school would greatly suffer therefrom. The task of "selling" the various courses to the men devolves upon the Trade Test Department. It is something which requires tact, judgment, and a high degree of diplomacy, not to mention the great amount of time.

It is due to the great amount of attention and conscientious application given to this matter that the present efficiency of the Trade Test Department is, as before stated, 97.8 per cent. As a testimonial to the success of this method, several men who have completed courses have come to the Trade Test Department upon graduation and candidly admitted that in "selling" them the course of instruction, other than that which they thought they desired, the Trade Test had benefited them, and students, materially.

The compilation of statistical reports above mentioned does not cover the period from July, 1921, to the present date, and of this period much can be said. The first outstanding event in the life of the Trade Test Department for the period named was the ordering of the Chief Trade Expert to Mitchel Field, Long Island, N. Y., where he interviewed and trade-tested 600 enlisted men for the purpose of ascertaining their mechanical and mental qualifications. These qualifications were forwarded to the Chief of Air Service for file and reference. Closely following this, 150 men reported to the Air Service Mechanics School from Mitchel Field for courses, as a direct result of the trade-testing carried on shortly before. It is needless to say that these men proved to be very exceptional material, compared with a later detachment of enlisted men who had not been classified. Thus, the value of the Trade Test was again exemplified. Following this was a period of inactivity, due to the reduction of the army. However, with the transfer of the Air Service Mechanics School from Kelly Field, San Antonio, Texas, to Chanute Field, Rantoul, Ill., the old "go-get-em" spirit was again in evidence in the recruiting drive, which took place in December, 1921, and January, 1922. In selecting men for enlistment, all candidates were given a short preliminary test by the officer in charge of the recruiting station. If, in his estimation, the applicant was deemed desirable, he was sent to Chanute Field and given a trade test to further determine his qualifications. If found suitable for the Air Service by the board, they were enlisted. Before being placed in courses of instruction, all men enlisted were again trade-tested and their records made. During the recruiting drive 713 men were interviewed by the Trade Test Department to determine their qualifications for enlistment in the Air Service. Of this number, 119 were rejected by the Trade Test Department as possessing neither the mental nor mechanical qualifications for Air Service work. Of these 119 rejected men the Trade Test Department was successful in obtaining fifty for other branches of the Service. Again, the figures tell a story, but not the half of it. They do not tell of the midnight oil burnt, of the hoarse voices, of the meals missed, of the perspiration splattered and nobly shed through the line when the old thermo had contracted itself about the zero mark. The foregoing little tale of the Department speaks for itself. Now let us strike off at a tangent.

The Officer in Charge of this Department has so many titles that if he had a tin badge for each one and they were pinned on him, the admiring public would have serious difficulty in discovering his noble physiognomy beneath the mass of medals. In addition to this, he is the lowest ranking member of the school's staff and, therefore, catches every job which is tossed nimbly down the line. Having no alternative, he has to do the work. Nevertheless, he has spent, does and will spend many sleepless nights praying Heaven to send a still lower ranking officer to Chanute Field so that he can engage in the daily diversion of "buck passing." Somewhat of an idea of this man's activity may be gleaned from an enumeration of a few of his titles, viz.: Officer in Charge of Trade Test, E. & R. Officer; Information Officer; Athletic Officer; Publicity Officer; Morale Officer; Member of G. C. M.; Secretary of Officer's Club; Engineer Officer, 15th Observation Squadron; Transportation Officer, 15th Observation Squadron, and Athletic Officer, 15th Observation Squadron. Again a story is told, hut not the half of it—not a quarter of it. In addition to handling the duties aforementioned with enviable efficiency, this Department is also the recipient of all jobs, ordinary, extraordinary and otherwise, i.e., selling peanuts, near beer, austioning off left-overs from the flying circus, organizing baseball, football, and track teams, building tennis courts and baseball diamonds, running picture shows, promoting boxing matches and coaching athletic teams.

These are only some of the glorious tasks accomplished by this Department. It has done everything that is possible to be done on a large and well ordered flying field, even unto caring for the Pathe News camera man, who at one time infested the field for the purpose of photographing parachute jumps and other aerial activities. This Department is proud of its record. "Grin and bear it" is the motto; "Lay on MacDuff" is the slogan.

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FOREIGN NEWS

Wireless Position-Finding for Aircraft

The British Air Ministry issued recently the following memorandum: Since October of last year a wireless "position-finding" system has been under trial to enable air pilots to ascertain their position when flying on the Cross-Channel Airways. This system has, on several occasions, proved to be of particular advantage in adverse weather conditions, and has been introduced as a regular feature of the civil aviation wireless service. It is a further development of wireless direction finding which, during the past two years has proved of such great value to air navigation.

Until last October direction finding work was carried out only by the Civil Aviation Wireless Station at the London Air Fort of Croydon, and was limited to giving a pilot his compass bearing from that station. The Direction Finding station at Pulham Airship Base, Norfolk, has been successfully operated as the second station of the system during the past six months, thus enabling two bearings to be taken simultaneously upon a single aircraft, and its position determined by plotting the bearings upon a chart, the point of intersection giving the aircraft's position.

Direct intercommunication between Croydon and Pulham is effected by radio-telephony, and the pilot can be informed of his position with a high degree of accuracy under normal conditions. The radius of action for giving position is approximately 200 miles from the control station, which in this case is Croydon. Although primarily designed for radio-telephony, the system is equally adaptable for radio-telegraphy; the change over being carried into effect by a simple switch in a few seconds. The position can normally be given within two minutes. Similar facilities can be afforded from Croydon to aircraft engaged on inland flights and services.

Several instances have already occurred in cases of fog and storm where pilots have been informed of their position and enabled to reach their aerodromes in safety. The most noteworthy occasion was in February last, when an aeroplane flying over the airway between Paris and London was navigated entirely by wireless, the pilot seeing the ground only on one occasion for a few minutes.

Pilots and navigators have been strongly urged in a Notice to Airmen which has just been issued explaining the working of the system, to make a practice of utilizing on every flight this important aid to navigation, as the experience gained in the use of position finding in good weather when pilots should be able to check the accuracy of the positions will add to their confidence and proficiency in using the system when flying in bad weather.

It is therefore hoped that they will take full advantage of the opportunity thus offered of increasing the security of air navigation.

British Seaplane Floating Dock

It is announced that the seaplane floating dock, which has been under construction at Sheerness Dockyard to the orders of the Air Ministry, has now been delivered as ready for service. For the present, the craft has been berthed in the Medway, near Port Victoria. The dock, which has an over-all length of 143 ft. and a lifting capacity of 200 tons, will accommodate two large modern seaplanes, has thirteen buoyancy compartments, each flooded direct from the sea and emptied by blowing with compressed air. The power for the air compressors is supplied by two oil-driven dynamos, which also provide the current for lighting and power for workshop machinery, capstans, winches and pumps. An interesting feature is the supply of petrol to seaplanes from a large storage tank on the deck by means of the Bywater hydraulic system.—*Flight.*

Franco-Roumanian Co.

The Franco-Roumanian Air Navigation Co., which has been running an air service from Paris to Prague and Warsaw, is now about to inaugurate an extension of their service from Prague to Vienna to Budapest. The new service is to run three times a week, and the time taken will be two hours from Prague to Vienna and about 1¾ hours from Vienna to Budapest.

French Seaplane Contest

The French seaplane contest (Marseilles-Monaco-Marseilles) was run off on April 19th, when six naval and two civilian pilots took part. M. Eynac, Under Secretary of State for Aeronautics, evinced the keenest interest in the event, and had flown, in a Goliath, from Paris to Marseilles, in 5½ hours flying time, a couple of days previously, in order to be present at the start and finish. The finish found M. Poiree, on a 135 h.p. Clerget-Caudron, the winner in 5 hours, 1 min., Brou on a Farman being second in 8 hours and 14 minutes.

Aircraft Industry in Austria

The Australian Aircraft & Engineering Co., has recently submitted a request to the Government for a subsidy to establish and develop the aircraft industry in Australia. The company states that, unless further orders are placed by the Government, it will be out of work in three months, on completing the six Avro aeroplanes it is now working on at Mascot, New South Wales. Australian timber is being used by the company, and it builds all parts of the aeroplanes except the engines.
Industrial Australian.

Aviation in Argentina

It is estimated that there are 173 aeroplanes in Argentina, of which 53 belong to the army. Of the total number, 88 are French, 30 are American, 24 are British, 4 are Italian, 11 are German, and 16 are of various makes. The Compania Rio Platense de Aviacion made 84 trips and carried 281 passengers between Buenos Aires and Montevideo up to March 1. The cost of the round trip between the two cities is 140 pesos, including the automobile transportation to and from the field. The time of flight is 1 hour and 45 minutes, in contrast to the trip of 9 hours by boat which costs 45 pesos. (Trade Commissioner George S. Brady, Buenos Aires)

Commercial Aviation in Peru

The existing transportation situation in South American countries appears to be one requiring considerable development, and to those who find it necessary to make frequent journeys over long distances it means much delay, discomfort and inconvenience. The remedy for this state of affairs would appear to lie in the advent of commercial aviation which, if organized along the proper lines, should tend to greatly facilitate travel and aid in no small measure in the development of those countries.

A recent issue of the *West Coast Leader*, Lima, Peru, prints an interview had with Gen. A. S. Cooper, Representative in Lima of the Peruvian Corporation, giving an interesting account of an aeroplane journey made by him to inspect his Company's properties in northern Peru, using one of the machines of the Cia. National Aeronautica. He returned safely from his trip after an absence of six days, having covered an area of territory which by normal means of transport would have required as many weeks.

In the course of his interview, General Cooper spoke as follows:

"My difficulty in making periodical inspections of our properties in Chimbote, Trujillo, Pacasmayo and Paita is the steamer communications. At the best, by using launches, motor cars and steamers, it is possible to do it in about 25 days. This means about 10 days' work, 15 days' waiting and traveling, with much discomfort and inconvenience. I managed to hit off a Paita connection, but gave up the problem in despair of steamer connection in anything like reasonable time for the other ports.

"It occurred to me to ask Mr. Mott to call, with the result that he assured me that his company could solve the problem without the slightest difficulty. He informed me that he made a specialty of safe commercial flying and offered to place an aeroplane and pilot at my disposal at what I considered a very reasonable price.

"A short consideration showed me that his propostiion would result in a very considerable economy, taking into calculation the saving of time and the various expenses incidental to a combined launch, steamer and automobile proposition as incurred in my last inspection. Although I had some small experience in England of flying during war time and was not so certain of the comfort and safety, I, however, accepted Mr. Mott's assurance and left at 11 a. m. on the 22nd, in an ordinary Standard Curtiss 90 h.p., with Mr. Moore as pilot. We arrived at Chimbote at 3:45, at landing in Supe for petrol. This was an amusing incident. Mr. Moore circled over Supe and cut off his engine three times and then proceeded to a landing ground about 1.5 kilometers from the town. He got out of the machine and lighted a cigarette, and I said: 'What happens now?' He replied, 'A burro will come with gasoline.' In a few minutes we saw the donkey coming over the Pampas, urged by his owner, with three tins of gasoline, equal to the number of times that Mr. Moore cut out his engine over the town. The humble, but necessary, burro supplied the flying power to the machine and we were soon off again. I finished my work at Chimbote in two days, and at 1:10 o'clock on the 24th we left for Trujillo, arriving at 2:25, and landing on the football ground.

"We left Trujillo on the 26th, at 1:35, after a very courteous 'despedida (farewell) by the Prefect, Colonel Dertcano, and landed at Pacasmayo at 2:30. Mr. Moore had never landed at Pacasmayo, but I had given instructions for a suitable spot to be marked out—the requirements were not fully understood, and we had to land on an incline and across wind. However, this did not beat the pilot, and with a wriggle and kick and a small pancake he brought the machine to earth in front of about 500 admiring natives, for whom the enterprising railway manager had run over a cheap excursion. Mr. Moore afterwards selected a suitable ground.

"We left Pacasmayo, homeward bound, at 6:30 a. m. on the 28th, and as flying is hungry work, I arranged for desayuno (light breakfast) at Chimbote, finished up some work there; left at 10:10, picked up gasoline again in Supe, and arrived at Bellavista at 2:45 in the afternoon, after a 360-mile flight from Pacasmayo. I ungrudgingly admitted after landing that Mr. Mott's assurances as to security, convenience and comfort had been entirely substantiated. At no time during the journey did I feel any sense of insecurity, and Mr. Moore was always ready to start at the time I decided. I was particularly impressed with the care with which he tried over the machine and engine each time before leaving the ground.

"Whilst passing over barren parts of the coast I took a nap on one occasion and read a book on others. Mr. Moore flies at a very even pace and at a height of between 2,500 and 4,000 feet, and hardly uses his controls when in the air—or did not appear to do so—and I felt that in case of any mishap he could have landed the machine in safety.

"At times we passed through patches of thin air and experienced some bumping which, to a comparative novice, is a little disagreeable, but the extraordinary control which Mr. Moore has over his machine minimized the discomfort, which probably would not be felt at all after more experience.

"Even on the barren stretches of coast the coloring is always wonderful, and when over the openings of the various fertile valleys the view is extraordinarily pretty, especially after leaving Salaverry and approaching Santa Catalina Valley. One sees Trujillo appearing in a beautiful green setting, with its neat squares and streets and eastern looking churches and coloring, and a little beyond the Inca remains of Chan Chan are very clearly marked, also with squares and streets.

"The Chicama Valley with its enormous extension of intensive sugar cultivation is also very notable, with the large factories of Cartavio and Casa Grande. At about 4,000 feet the whole valley is spread out before one.

"I was sorry when the journey was over and also to say good-bye to a most pleasant traveling companion, and I shall certainly repeat the experience when occasion offers. A trip of this kind opens one's eyes to the possibilities of carefully organized commercial flying, especially in a country of difficult communications like Peru."

Austria's Air Achievement

The Australian Controller of Civil Aviation, Colonel H. Brinsmead, has set about his task in a wholehearted manner as the aerial routes already started in Australia bear witness. In connection with this work Colonel Brinsmead has recently completed a 9,000 miles aerial tour on the "Bristol" Tourer provided for his use. The flight, during which thousands of miles of practically unknown country were traversed, ranks as one of the finest flying achievements which has yet been recorded. To carry out this trip by any other than the aerial route would have been practically impossible. This flight must be added to the aeronautical feats already achieved by such notable Australians as Sir Ross Smith and Lieut. MacIntosh, and speaks well both for the Australian flying spirit and for the British design and workmanship embodied in the machine.

Brancker Civil Aviation Director

The British Air Ministry announces:—

Major-General Sir W. S. Brancker, K. C. B., A. F. C., has been appointed Director of Civil Aviation in the Air Ministry.

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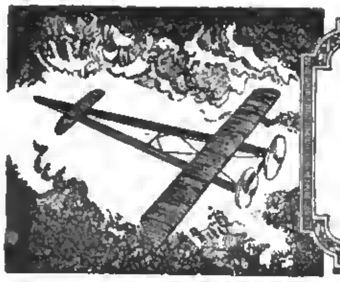
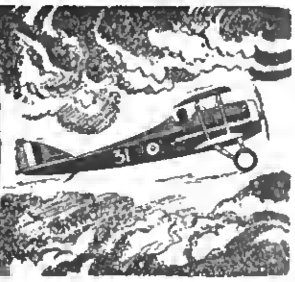


ELEMENTARY AERONAUTICS *and* MODEL NOTES



Model Aeroplane Details

(To be continued next week with illustrations of details mentioned)

DETAILS are an important consideration in anything, and especially in model aeroplanes. Therefore it would be well for anyone attempting to build a model to study carefully the drawings of the model, and more carefully study the details. Many of the I. M. A. C.'s so-called "secrets" are in this list of details; most of them have been used in the record breaking models and have enabled the club to capture and retain the whole ten of the officially recognized world's records. The records in no instance were made during freak weather conditions or from a favorable altitude—the field over which the land records were made being nearly as flat as the lake over which the Hydro records were made. These models hold their records on their merits alone, which means attention to details and design.

"CANS"—Tractor

Cans are one of the chief reasons for the light weight of the machines of the I. M. A. C. members. Even beginners, by the use of these cans, exceed the records held outside the club. The principle is so very simple—being the same practically as the eyelets on frail flexible fishing rods. By keeping the pull in either case more nearly parallel to the stick or rod, the fullest compressive strength of the material is utilized, because the sticks are not put to near so great a bending strain.

The first cans were really *cans* for they were in the form of a sleeve an inch or more in length and made from a tin can strip. Aluminum was then tried in the search for light weight. Then light strips of bamboo were used with a great deal of success for they were very light and stood a great deal of punishment; but one had to be very good at bending bamboo to make the small curves necessary.

Steel piano wire seems at this date to be the best for they are light, strong, and easy to form. The wire can even be flattened to streamline but this is not necessary. Great care should be taken not to get the cans too small or the rubber will catch on them. The size of the wire used is usually about as follows: No. 8 for six strands on a tractor, except the rear can which is always heavier to take the force of the rubber should it break, and others in proportion to the amount of rubber they must stand. The size of the opening runs about as follows: for two strands of 1/32" sq.—5/32" dia. cans; 2 st. ⅛" x 1/32 flat—7/32" dia.; 2 st. 3/16" x 1/32" flat—¼" dia.; 4 st. 3/16" x 1/32" flat—⅜" dia.; 5 st. 3/16" x 1/32" flat—7/16" dia.; and for 6 st. 3/16 x 1/32" flat rubber, ½" oval cans were used. The cans never receive any great strain except when the rubber breaks and this should not happen very often. However, care should be taken to fasten the cans securely to the stick for many contests have been lost through the loosening or losing of a can.

"CANS"—Twin Pusher

Twin push cans should be made of slightly heavier wire than is used for tractors on the same number of strands, because they are usually only supported on the one side. The opening may also be made larger for they do not take any strain unless the wing or a bad landing temporarily bends the motor-base, while the cans on a light tractor motor-base take some of the constant bending pull which must be kept as low as possible by small cans keeping the rubber close to the motor-base. In a twin there is no bending strain except at the rear can next to the propellers which can be stopped by a thread across the X brace. Two, or better still three cans is the common number for twin or tractor.

"S" Hooks

A—is the old style of "s" hook. It always slipped out of the winder or the front hook of the model and caused much trouble. B—is a much better shape of "s" hook for it will not tear the rubber when it is being slipped into the hook and if properly made it will not slip out of the front or rear hook as the case may be. There is more wire in it but it is a much better hook and is not much more difficult to make. C—is no better than B except that it can be made of lighter wire because of the safety hook arrangement. It is unhooked like a safety pin and the rubber inserted then it is locked up again. No. 5 wire will hold 2 strands of ⅛" flat rubber; No. 7, 2 st. 3/16" flat rubber; No. 11, 4 st. 3/16" flat rubber; No. 12, 5 st. 3/16" flat; No. 13, 6 & 7 st. etc. This covers all the power units common to I. M. A. C. models. One or two sizes smaller wire can be used with the safety hooks but that is getting on dangerous ground. Always have the one side of the "s" hook big enough to fit in the winder yet small enough to prevent it from coming unhooked during flight.

Twin-Push Motor Hooks

Hooks for large or small machines can be made as shown. A good plan is to have the eyelets that the "s" hook fits into longer than seems necessary in order that there will be no opening for the "s" hook to slip out of. The wire sizes are the same or one size larger than the "s" hook for the same number of strands.

Tractor Motor Hooks

Follow the same good plan of extending the wire past the upright piece on the part where the "s" hook fastens, to prevent the "s" hook from slipping around and coming out. When a frail wire hook is used the rear end of the eyelet should be twisted around the upright part of the eyelet to prevent it from coming out.

Hangers and Bearings

These hangers are of the lightest and strongest style as well as the simplest bearing in one piece yet devised. "C" shows a common nail without a head as used in making a bearing. "B" shows the nail flattened on both ends and drilled through the head end. "A" shows the finished hanger after being bent and the drilled hole countersunk from the rear, filed smooth, corners rounded, and the position it is mounted on a twin pusher.

Wire Bearings

Wire bearings suitable only on small models and then mostly on tractors. "A" shows one kind fastened to the top of the motor-base. "B" is a variation in which the one end is pushed through and bent on the bottom of the stick. This is not supposed to come loose but if "A" is fastened on well the extra trouble required to make "B" is wasted. Make the hole as round as possible.

Motor Base Sections

Motor base sections are an important consideration for at least one quarter or more often one third of the total weight is in the frame. "A" is the most common style of motorstick. It is generally pine or spruce planed to size with the corners well rounded for streamline. The size shown in the drawings would easily hold five strands and would hold six if well braced on a twin push. For a tractor it would just hold four strands and possibly five well braced with cans. "B" is a section of a hollow spar (incidently a section of B. Ponds record tractor). The easiest way to make these is to make a U-shaped section and then glue a cap on to it. The cap must be fastened securely. The spar should be held tightly against a flat surface while the glue is setting. The U-shaped section of the cap can be quickly made to the approximate size on a circular saw and finished with a plane and sandpaper.

"C" is the section of a Balsa spar suitable for six strands. This spar is well rounded to streamline it. "D" is practically a full size section of Mr. B. Pond's dual world's record channel-spar twin push frame. This frame stood five strands nicely. It was easily constructed with the use of a rounded wood-carver's chisel. "C"-"D" are not suitable for tractors but a Balsa spar of the size and shape of "B" should hold (hold in this case means just hold) five or six strands or about the same as a hollow pine spar of the size shown with walls .025" in thickness. "B" will hold 8 or 9 strands on a twin pusher.

Balancing Hook

A balancing hook for propellers is made from a small piece of piano wire. The shaft of fthe propeller "C" rests down on "B" and rests up against "A". With the aid of this hook the heavy side of a propeller can be detected and corrected. All propellers must be accurately balanced for the best results.

(*To be continued*)

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RADIO DIGEST

Overland Radio of Air Mail Completed

Some time in the near future, when you are juggling with your controls and get on a moderately long wave, if you should happen to hear some one saying "This is Jones, on No. 6 night mail, westbound, in thick fog, altitude 3,000 feet," do not be surprised nor alarmed. You will be listening to one of the United States air mail planes reporting by radiophone.

The Air Mail Service is doing some wonderful pioneer work, despite the fact that Congress has been extremely niggardly in allotting appropriations to that important service. It is laying the foundation for the future commercial air transport that will revolutionize physical communication in this country. In addition to this, however, it is also developing the most modern form of instantaneous communication which will materially aid in removing the last remaining preventable cause of aircraft danger.

The splendid program of communication development planned by the Air Mail Service is now being completed and should be in full operation within the next six months. This program will include a complete network of intercommunication across the entire transcontinental air route, as well as complete means of intercommunication between aircraft and between aircraft and ground stations.

Radio Compass System Complete

In addition to this there will be a complete system of radio compass stations to guide machines straight to their destination, and there will also be radio field locaters, which will enable aeroplanes caught in a fog to spiral gracefully down to a safe landing in the center of the field, despite weather conditions. With these complete systems in full working condition night flying (which is imperative to a successful air mail service) will be made not only possible, but measurably safe.

The most remarkable thing about this development is the fact that the officers responsible for it did not permit the parsimony of Congress to interfere with their plans. Having been cut down to the last cent by an unsympathetic appropriating body, the officers simply changed their tactics and developed the more essential parts of the system first, and left the application of the entire system to a more favorable period. The story of their achievement is best told in chronological form, and it is a story of real historical value.

It began shortly after the inauguration of the Air Mail Service, when the only practicable route was between New York and Washington. In the latter part of 1919 extensive experiments were made with radio direction finders upon aircraft flying between those two cities. The instruments upon the aeroplanes were designed with the prime idea of simplicity compatible with successful operation, in order that a minimum amount of attention would be required of the pilot. These experiments were eminently successful, and as a result of them the surest method of air navigation has been developed—the radio compass.

During the period of these experiments it was realized that while the radio direction finder and the radio beacon stations would permit an aeroplane to determine its exact position, the system itself would not permit a pilot to make a safe landing in foggy weather when he had reached his landing field.

Radio Field Locater Developed

The solution to this difficulty, it was realized, lay in devising a system of radio communication that would indicate to the pilot just when he was over the center of his landing field, so that he could spiral gently down through the fog. As a result of this determination the radio field locater was developed successfully.

In the fall of 1920 radio communication and radio aids were applied to the big twin engined Martin mail planes and a radio operator was placed aboard the machines of this type. In the terse words of the official report upon these operations "great success was obtained and these radio adjuncts were developed to a practical point."

It was at this juncture, however, that Congress stepped in and put the brakes upon further rapid development by cutting down the already meager appropriations for this service. As a result of this situation the officials of the air mail service were compelled to abandon completely all further experimentation with radio apparatus aboard the aircraft, and due to the act of Congress the air mail planes have been flying for two years without any of these necessary means of communication.

In the mean time, however, the officers of the air mail were not to be discouraged by this situation; so, thwarted in their major purpose, they went ahead as best they could with the facilities at their disposal. The result is that after two years of intensive work there exists at the present moment a complete network of intercommunication across the country operated by the air mail service.

Fifteen Stations in Service

This communication service consists of no less than fifteen five-kilowatt arc wireless telegraph stations and one large radiophone communication. The former have a normal daylight communication range of approximately 400 miles, and of course, much further at night. In addition to their value as a means of intercommunication the stations can also be used for airplane control work—such as radio direction finding and for the purpose of issuing orders to pilots of mail planes while they are en route between two air mail stations.

Now that this ground system has been established, officials of the Postoffice Department, in a letter, inform me that the work of equipping airplanes with direct finders and radio telephones is now under way. The preliminary installation is now being made, and there is every prospect of the operation of a complete system on the planes within the next six months. The work is being done in conjunction with the plans for the development of night flying along the transcontinental air routes.

As a result of the splendid development program of the air mail service, the investment represented in the establishment of the transcontinental communication system has been wisely made, and from present indications the government will soon recover its cost in the amount saved from the transmission of messages. In this connection the report sent to me reads as follows:

"Our ground control stations now handle an average of about 600,000 words a month at a cost of approximately $0.007 a word, based on expenses of operation and maintenance over the whole circuit."

This in itself is a remarkable record, but when the possibilities of the system in connection with rendering safety service to aircraft are taken into consideration also, the value of the investment to the people of the country becomes apparent. There should be no stifling of the air mail development.—Jack Binns, in N. Y. Tribune.

Almost Twenty Thousand Radio Senders in U. S.

A survey of all radio transmitting stations licensed by the Department of Commerce shows that there are 19,067 stations. Of this number 15,495 are amateur stations, 348 experimental, 2,783 American ships, and the balance, 439, commercial stations.

Of this last number, there are today 274 broadcasting stations, known as limited commercial stations. They comprise universities, municipalities, newspapers, electrical manufacturers and retail stores, sending entertainment or information on weather, crops and market reports.

The growth of this class of radio stations has been remarkable; it jumped from sixty-seven stations a little over two months ago to 274 today. Applications are filed on an average of about three or four a day.

Transmitting Stations

Trans-oceanic	11
General public or "ship in shore"	31
Point to point	124
Broadcasting	274
American ships	2,783
Experimental	225
Technical and training schools	123
Amateur	15,294
Special amateur	201
Total	19,067

Amateurs by Districts

1—Boston	2,490
2—New York	2,313
3—Baltimore	1,831
4—Baltimore (Savannah)	319
5—New Orleans	699
6—San Francisco	1,616
7—Seattle	726
8—Detroit	2,393
9—Chicago	2,907
Total	15,294

The Department of Commerce does not regulate or record receiving stations and will not guess at the total number, now unofficially estimated at about a million and a half.

Pick With Care The Parts for Loud Speaker

By B. Bradbury

Radio Engineer, General Electric

After some weeks or months of listening to radio broadcast programs by the use

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of head receivers, it generally becomes desirable to install a loud speaking device which will make the signals audible throughout the room and enable several people to hear from at the same time. There is also the further desirability of securing signal intensifiers loud enough for dancing or concerts, where the music must be heard throughout a fairly good-sized hall.

To secure this amplification and at the same time maintain the original quality of the signal, it is necessary to observe a number of precautions in the selection and operation of the apparatus used.

Assuming that the signal directly from the detector is of good quality and loud enough to be heard distinctly in the head receivers, our problem is chiefly concerned in the maintenance of this quality, since it is a comparatively simple matter to obtain the necessary intensity.

In order to eliminate or minimize loud speaker distortion it is necessary to know the causes involved. The source of trouble may be in the amplifier, in the loud speaker itself, or in both.

For good amplification of telephone signals the interstage transformer should be capable of giving a uniform transfer of voltage from about two hundred to three thousand cycles a second. A good many transformers in use do not do this, and their operation is one of the principle causes for unsatisfactory signals. For any particular plate voltage applied to an amplifier tube there is a corresponding value of negative grid voltage which should be applied in order to operate upon a straight portion of the characteristic curve, and thus secure uniform amplification. With forty volts on the plate the negative grid bias should be about one volt, and with 100 volts on the plate the grid bias should be about four volts negative. Standard amplifier tubes will generally operate with two tubes in cascade without overloading them. Where more volume is desired for very strong signals it is preferable to use for the third stage a small-power tube with three or four hundred volts on the plate. The grid voltage in this case should be about twenty to twenty-five volts negative. This will hold the plate current down to normal value and operate upon a straight portion of the characteristic. It is also well to use reactance coupling between the second and third tubes, as this will cause very little distortion and will give good amplification.

For connecting to the loud speaker, especially when using a power tube for the last stage, it is preferable to use an intermediate transformer with the proper constants, instead of placing the loud speaker directly in the tube plate circuit. This keeps the plate current out of the loud speaker winding and prevents the polarizing effect that it would have upon the diaphragm.

A two-stage amplifier will generally give enough intensity to operate a loud speaker in an ordinary living room, while the loud speaker mechanism itself may be of the head telephone type with a suitable horn. Some receivers operate very well at moderate intensities, but when very strong signals are applied to them they vibrate so violently that the diaphragms hit the pole pieces and produce harsh sounds instead of good reproduction of the original signals. To handle the proper amount of energy, therefore, the construction must be such that reasonably strong vibrations will not force the diaphragm to its limit of travel. The material and shape of the diaphragm are also important in determining the resultant tone qualities, since whatever natural periods of vibration it may have will bring out certain tones in greater proportion than they should be to the remaining tones of a musical selection.

The size, shape and material of the horn are likewise important factors in the final result. The high natural period of a small horn will tend to accentuate the higher tones to the exclusion of the lower ones. The material from which the horn is made should be some substance which will not vibrate readily and produce rattling sounds.—N. Y. Tribune.

Loop Aerial for Autos Made Upon a Parasol

Many types of portable wireless receiving sets have been devised, but in all cases it is necessary to provide a ground to complete the circuit and in most cases it is necessary to stretch an aerial when signals are desired. Neither is necessary in a new parasol receiver just recently perfected by John B. Taylor, consulting engineer of Schenectady.

This parasol outfit is very simple in construction and easy to operate. It is very compact and light. A loop aerial of braided copper wire, which is very flexible, is sewed to the covering of the parasol in parallel lines, resembling braid, near the edge. Either end of this wire leads through eyelets along the main road to the handle, where a small condenser and crystal detector are attached. By varying the condenser, the set may be tuned for the different sending stations' wave lengths. On this small apparatus on the handle are attached the headphones, and all that is necessary to hear the signals or concerts from any station within the range of a crystal receiver is to point the parasol in the direction of the station. It operates much the same as a loop aerial in this respect.

The parasol can be lowered just as easily as any parasol. There is nothing freakish about its apearance and when closed looks just the same as any other parasol.

Mr. Taylor has made frequent tests of the device in the vicinity of Schenectady and has been able to hear signals and music broadcast from WGY, when ten miles away. Evenings while motoring in his car, he raises the parasol in the back seat and can plainly hear the concerts from WGY while riding about the suburban sections of Schenectady.

Protest Radio Ban on Political Talks

Washington.—The American Radio Association is dissatisfied with the decision of the Government to refuse permission for the broadcasting of political speeches by Government radio and intends to seek a modification of the new rule.

F. W. Brown, executive officer of the association, said that he would take up the matter immediately with Secretary Hoover with a view to having him issue orders that beginning two weeks prior to the November elections and lasting until election day, candidates for public office shall be permitted to use the Government radio stations for broadcasting addresses during certain hours of the day.

"The majority of people are interested in politics," said Mr. Brown. "Through a canvass of the thousands of members in our organization, we find that approximately two-thirds are eager to hear the various men running for office. Such a step taken by the Government would meet with the approval of the majority of radio enthusiasts, we feel certain, providing that there is a limit of two weeks, and permissible during certain hours of the day only. We do not think that the air should be full of political speeches all day long, however."

The decision of the Government to refuse permission for the use of its radio service for broadcasting political speeches was announced on May 20, when Theodore Roosevelt, Acting Secretary of the Navy, notified representatives of the Woman's Party that he would be obliged to deny their application for the use of the naval radio service for broadcasting speeches and music on the occasion of the dedication of the Woman's Party headquarters in Washington on May 21. He gave as a reason that it had been decided to discontinue the practice of permitting naval radio to be used for political purposes.

The action of the Acting Secretary of the Navy caused surprise, as Secretary Denby was understood to have granted previously the permission sought by the Woman's Party received a letter from cation ceremonies the officers of the Woman's Party received a letter from President Harding withdrawing the acceptance he had given in December to the invitation to attend the dedication. No explanation for the declination was contained in the President's letter.

There has been considerable mystery over the action of the President and the Acting Secretary of the Navy. Nothing has appeared to indicate that either the President or Acting Secretary Roosevelt had any objection to the Woman's Party as an organization, but it is evident that the rule to refuse permits to use Government radio for sending out political speeches had a connection with the dedication of the party's headquarters.

Radio Controlled Aeroplanes

Control of aeroplanes by radio is recorded as a notable achievement in France. A large machine was taken up. The pilot allowed his "ship" to be maneuvered for over an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Government Gets Share Radio Boom

Over 2,000 per cent increase in revenue was derived by the United States Government from private and commercial radio stations in 1921 over the year 1917. The earnings of these stations are estimated to be in excess of $1,600,000 and show a profit of more than 15 per cent on the Government's investment of $25,000,000.

Sweden to Talk to America

Sweden expects to talk direct to America when the gigantic station in that country is completed. An agreement with the Radio Corporation of America and the Swedish State Telegraph Board will bring about the undertaking. Sweden's wireless communications are now dispatched from the station at Stavanger, Norway.

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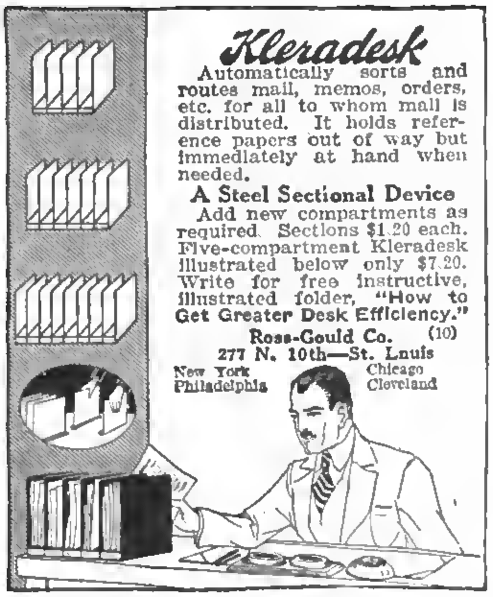

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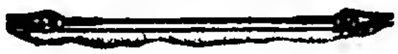

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OX5, 8 Cyl., 90 H.P. Curtiss Hammondsport in original Boxes $400. OX5 Motor, overhauled, splendid condition $550; not overhauled $200. Overhauled OXX-0 100 H.P. splendid condition $470; slightly used OXX 150 H.P. $500; New 180 H.P. Hispano $875; new 150 H.P. Hispano $850; 150 H.P. Mercedes $700; 150 H.P. Benz $675; 8 Cylinder 315 H.P. Liberty $550; 60 H.P. air-cooled 8 cyl. Kemp $250.

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Canucks $850 and up; Curtiss JN4D's $650 and up; JN4D specials $1350 and up; J-1 Standard with almost new motor $1350; J-1 Standard, less motor, ready for OX $1150. J-1 Standard, less motor, just as received from Gov't in original boxes $800. 3-Pass. Standards with choice new 150 to 150 H.P. Motor $3150 to $3600. Orioles $3050 to $4800.

Flying Boats

Slightly used Curtiss F Boat with OXX 160 H.P. Motor $1125; New M. F. Boat with Curtiss 100 H.P. Motor, not installed, $1270; M. F. Boat, less Motor, $070; M. F. Boat changed to 3 seater and equipped with new 150 or 180 H.P. Hispano $2900; Sea Gulls $5250 to $5600; HSL Boat $6550; with open cockpit 0 pass. $8500; inclosed cabin 8 pass. $10,500; F5L with 2 Liberty Motors, $17,600; converted into 11 pass. luxurious inclosed cabin cruiser $35,000.

Spares

Everything for Canuck, JN4D, J-1 Standard and OX5 Motor; New Wings $90; landing gear complete $75; radiator $20; wing strut with fittings $5; good center section with fittings $17.50; Wing cover Canuck or JN4D, linen upper $20; cotton upper $15; Canuck Wing cover lower, linen or cotton $14; Main Wing Beam $8; Grade A Mercerized cotton 40c yd.; cotton tape 6c yd.; Grade AA linen 90c yd.; linen tape 8c; new 26x4 Goodyear Cord Tires $7.50; slightly used $3.75; reasonably used, excellent condition $1.70; new tube $1.50; Guaranteed Nitrate Dope $2.50 per gal.; 0 gal. can $10; $75 per Barrel; acetate Dope, $50 per barrel; Valspar Varnish $5.50 per gal.; OAF spar varnish $3.25 per gal; Leather Helmets $0. NAK Resistal Goggles $6.70; CAL Propeller for OX5 $15; Buffalo mahogany metal tipped $35; Flottorp metal tipped latest design $47.50; Flottorp metal tipped regular $30; Compass (used) $10; Tachometer Head $7.50; oil gauges $3.50; thermometer $6. Climb and banking indicator combined $12.50; recording barograph $20; altimeters $10.

The F. O. B. Point on above varies from New York to Houston.

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The Glenn L. Martin Flying Field and Factory, Cleveland, Ohio

From Portugal to Brazil by Air—Commercial Aviation—The Choice of Air Routes

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June 19, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 15

TABLE OF CONTENTS

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VISITING REMOTE POINTS
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AERIAL ADVERTISING
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With which Flying *is consolidated*

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From Portugal to Brazil by Air

THE Portuguese aviators who started from Lisbon for the South American coast have at last reached their destination, but instead of taking a few days the journey consumed more than two months, the first hop having been made on March 30. Captains Sacaduro and Coutinho did not play in luck; two of their machines were broken in landing and they had to wait at Fernando Noronha until new planes arrived from Lisbon.

Under the circumstances the voyage by seaplane from Portugal to Brazil, the first westward crossing of the Atlantic by a heavier than air flying machine, does not thrill the public as did the feats of the NC-4 and Alcock and Brown. The Portuguese made four stops between Lisbon and Permanbuco: the Canaries, the Cape Verde Islands, St. Pauls Rock and Fernando Noronha. This may sound like cautious proceeding, but some of the hops were of about 1,000 miles across lonely seas.

As the Portuguese Minister in Washington says, the voyage at least demonstrated the efficiency of the new methods of air navigation. The trip was slow but sure. To be able to reach such a tiny target as St. Pauls Rock required precision in instruments and their use. The aviators used a new type of sextant which is independent of the sea level horizon and another instrument which advised them of errors in their course more accurately than a compass could do.

So, aside from the sentimental triumph of the Portuguese in being the first Europeans to reach by air the great Western republic which Portugal colonized and which speaks her tongue, something useful was accomplished by the trip. The aviators demonstrated the accuracy of flight and the inaccuracy of landing methods. It was, as usual, easier to sail than to come to earth. But if Louis Brennan has perfected the helicopter the problems of landing will soon disappear from aviation.—*Editorial in N. Y. Herald.*

The Flying Contrabandist

THE forced landing near Croton-on-Hudson of an aeroplane carrying whiskey from Canada, with the escape of the pilot in a waiting automobile, makes a story of unusual interest. A bootlegging airship has not been reported before, but it doesn't follow that it is a novelty to the illicit trade in rum. Fiction has surrounded the smuggler with an atmosphere of romance, mainly because he must be daring and his occupation involves him in bodily risk. There would be a gap in literature if the contrabandist were left out. Such was the unknown from Montreal, who seems to have arrived at the rendezvous too late to transfer his prize to the "agents," and had to plane down to an inhospitable hill, where he came to grief with a crash that involved most of his consignment.

This fashion of scorning the Mullan-Gage law of the State of New York is not likely to be a success at present. The exhaust of an aeroplane and the whir of the propellers make too much noise, and everybody follows the flight of a strange ship with curious eye. The aeroplane is still a spectacle. In this case mounted troopers of the State came in hot haste to the wreck to seize the contraband and nab the lawbreaker. It might have been hard to empanel a jury to convict him if he had been apprehended. In course of time there must be a State police driving aeroplanes as well as riding horses. Then suspicious planes will be "held up" or followed by "traffic cops" lying along aerial routes connecting such cities as Montreal and New York.

In that day there will be an air code as thick as a volume of the Supreme Court reports. Flying will be strictly regulated, and there will be aerodromes very few miles, with lighthouses at night. Planes will carry numbers to identify them, and they will be darting in all directions, carrying passengers and perishable freight. Rogues, as well as honest men, will be in the air, and the flying police will often have difficulty in distinguishing them. The automobile long ago became a vehicle useful in crime, and the aeroplane will also be. All kinds of portable, ill-gotten goods will be coursing through the air, and thieftaking will become more of a problem than ever.

Flying cannot be regulated too soon for the protection of the public. Commercial aviation is developing rapidly. With better safeguards for passengers, more of them are traveling through the sky. Air limousines now fly thousands of miles without accident. Merchants who want a new market are patronizing the air-carriers. Spring fruits and vegetables can be delivered fresh hundreds of miles away. Mullica, down in sandy South New Jersey, is planning to ship asparagus by plane to Boston every afternoon. But the bootlegger will certainly use the plane to carry his outlawed goods.—*Editorial in N. Y. Times.*

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THE NEWS OF THE WEEK

Portuguese Aviators Cross the Atlantic

PERNAMBUCO, Brazil—The Portuguese naval aviators, Captains Sacadura and Coutinho, arrived here shortly after noon June 5, having flown in their hydro-aeroplane from Fernando Noronha, thus completing their transatlantic flight of more than four thousand miles from Lisbon.

The aviators were greeted with a monster reception as they landed in the harbor. At least one hundred large boats and many smaller craft belonging to athletic societies and rowing clubs went out to meet them. Before coming down the aviators took a flight over the city.

The whole population was delirious with excitement. All ships at anchor sounded their whistles, church bells were rung, automobiles honked their horns and factories blew their whistles—all in one deafening medley.

In spite of the rain, the streets of the city were thronged, and all business was stopped for the day. The three-mile quay was crowded from one end to the other. The population staged a parade as the aviators came ashore.

The program of receptions and festivities which had been planned were cut short, because the aviators plan to continue their flight to Rio de Janeiro.

The aviators used three aeroplanes in their flight, which began in April. Two of them were badly damaged in landings, and the time required to ship new planes from Lisbon occasioned the delay in reaching South America.

The flight from Lisbon to Brazil by Captains Sacadura and Coutinho demonstrated, as intended, "the practical efficiency of the new methods of air navigation," Viscount d'Alte, Portuguese Minister in Washington declared in a statement issued when informed by The Associated Press of the success of the venture.

It was also their purpose, he said, to prove the accuracy of instruments recently devised by the aviators. Among these, he said, was a modified type of sextant which permitted the flyers to take observations without recourse to the sea level horizon and a modified sextant used as a "route corrector" while the machine was in flight. The efficacy of the new instruments was declared to have been established by the "remarkable precision of the flight just completed."

Flier to Join Amundsen

Seattle.—Lieut. G. L. Fullerton, Canadian flier, is in Seattle from Ottawa to join the Amundsen expedition to the North Pole.

Lieut. Fullerton has had extensive experience in flying in northern climates and will go ahead by plane to map out the course of the exploration ship Maud, and to make meteorological observations.

Spokane News

A verdict for $2,000 and costs was brought in by a jury in the damage suit of the Yakima Aviation Company against R. E. Hull for insurance on an aeroplane after a trial lasting two days. The jury was out hut a short time. The plaintiff sued for $3,000, the amount of the coverage which, according to evidence, he had been assured was provided, while the defense introduced witnesses in an effort to prove that the plane was not worth that much when the insurance was placed.

Leaving Walla Walla at 9:15 a. m. in two army aeroplanes, bound for Spokane via Lewiston and Pullman, Lieutenants Ned Schramm and H. C. Minter reached this city at 11:30 o'clock and spoke at the noon luncheon of the military affairs committee of the Chamber of Commerce.

The army pilots drove their machines more than 160 miles in 2 hours and 15 minutes. The planes, after circling the city, landed at the Parkwater aviation field, where C. H. Messer, local aviator, met the officer pilots. Staff Sergeant Charles A. Datto and John E. Gordon are accompanying the two lieutenants on the trips as mechanics.

The Glenn L. Martin Flying Field

The Glenn L. Mart'n factory and flying field, shown in cover illustration this week, is located about seven miles from the center of Cleveland in the eastern section of the city. Situated between the main lines of the New York Central and Nickel Plate railroads and one mile from the lake front, it is readily located from the air. An easily distinguished landmark is the New York Central freight yards, partially shown in the right foreground of the photograph.

This field is open to commercial and civilian flyers and adequate ground service is always available. Underground tanks with a capacity of 2,000 gallons of high-test gasoline provides for any contingency.

The field is L-shaped and contains seventy acres. The main landing course, cinder-covered, is 1,900 feet long and always in good condition, being used daily by the Transcontinental Air Mail Service whose hangars and Cleveland headquarters are also located on the field. Weather reports are available through Navy Radio Station NRH, operated from the Company's field.

Other general information is as follows: Latitude, N. 41° 30'; Longitude, W. 81° 42'; Altitude, 762 feet; Average yearly rainfall, 34.24 inches; Average visibility, fair.

General Classification of Instruments and Problems, including Bibliograpby

This report (No. 125) by Mayo D. Hersey of the National Advisory Committee for Aeronautics is intended as a technical introduction to the series of reports on aeronautic instruments. It presents a discussion of those subjects which are common to all instruments. In the first place, a general classification is given, embracing all types of instruments used in aeronautics. The arrangement of information dealing with these various instruments throughout the reports is then briefly indicated as a guide to the reader. Finally a classification is given of the various problems confronted by the instrument expert and investigator. In this way the following groups of problems are brought up for ocnsidcration: First, problems of mechanical design; second, human factor; third, manufacturing problems; fourth, supply and selection of instruments; fifth, problems concerning the technique of testing; sixth, problems of installation; seventh, problems concerning the use of instruments; eighth, problems of maintenance; ninth, physical research problems. This enumeration of problems which are common to instruments in general serves to indicate the different points of view which should be kept freshly in mind in approaching the study of any particular instrument.

A copy of Report No. 125 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Lights For Night Flights of New York-Chicago Mail

Second Assistant Postmaster General Henderson, who has charge of the air mail servicc, is completing arrangements for establishing a great white way between New York and Chicago to guide night fliers in the mail service.

The Post Office Department has men prospecting the route and arranging to install great beacons not more than twenty-five miles apart. Regular and emergency landing fields, brilliantly lighted, will he installed. Chicago plans the construction of two immense landing fields suitable for night landing.

As soon as the Post Office. Department completes the survey of the night route and has the proper lights in operation a night air mail service will be inaugurated between New York and Chicago to take the place of the present day service.

Postal officials declare the air mail planes by flying at night can carry commercial paper between New York and Chicago in time for the opening of the banks in either city, a saving of one day's interest. It also would prevent embarrassing delays for business houses.

Night flights of air mail planes will be a radical departure for the air mail service. Officials do not intend to have night flying west of Chicago. From Chicago to San Francisco the service will be confined to day flights, for the present at least.

Aeroplane Will Bomb Pests in New Hampshire Forest

Boston.—An attempt to attack forestry pests from the air will be made in New Hampshire by Captain Robert E. Kinlock flying an army aeroplane. From a base to be established at Concord, it was announced today that the flier would circle Gunstock Mountain and other territory in the vicinity of Lake Winnipesaukee, dropping gas bombs as he goes.

The gases are fatal to insect pests, but not harmful to humans or to vegetation, it was said. The flight will be made under the auspices of the Federal Department of Agriculture.

Passenger Service From Knoxville to Elkmont

Aeroplane passenger service will be inaugurated between the Knoxville landing field and the New Appalachian club at Elkmont, acording to announcement made by officials of the Knoxville Aero corporation.

Thirty-minute schedules will be maintained between this city and the summer resort. A landing field is being cleared and the citizens of the Elkmont section will welcome the inauguration of the service. C. A. Griffith and J. G. Ray, manager and pilot of the Airship Knoxville, went to the New Appalachian club grounds yesterday and had a conference with R. S. Homel, in charge.

It has not been announced when the passenger carrying flights will be made to the mountain resort. The aeroplane will climb to an altitude of approximately 4000 feet to make the landing at the club grounds. This will be the first regular passenger-carrying line that has been established between Knoxville and a neighboring resort.

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The AIRCRAFT TRADE REVIEW

Limitations on German Aircraft

The limitations placed on the manufacture of aircraft after May 5, 1922, in compliance with the terms set forth in a note in the conference of ambassadors, in Paris, dated April 14, 1922, have just been received by the Automotive Division of the Department of Commerce. They prohibit the building of aeroplanes capable of better than a 3½ four-hour flight, or a distance of more than 600 kilometers. Rigid airships of more than 30,000 cubic meters gas content are likewise forbidden.

The terms laid down in the note from the council of ambassadors, translated from the French by the Automotive Division, are as follows:

(a) Aeroplanes

Article I. A one-seater aeroplane of more than sixty horsepower will be considered a military plane and thus war material.

Article II. An aeroplane capable of flying without a pilot will be considered a military plane.

Article III. Every aeroplane provided with armor plate or other means of protection, facilities for carrying armament of any kind—guns, torpedo bombs—and with aiming devices necessary for them, will be considered a military plane.

The following limits constitute the maximum for air craft heavier than air, and all aeroplanes which exceed these limits will be considered military planes:

Article IV. The maximum altitude at full load, 4,000 meters (a high-compression motor will bring the aeroplane in the military category).

Article V. Speed at full load and at an altitude of 2,000 meters, 170 kilometers (the motor at best efficiency and thus rendering the maximum power).

Article VI. Maximum carrying capacity for oil and fuel (the best quality for aviation use) shall not exceed $\frac{800 \times 170}{V}$ grams per horsepower, V being the speed of the machine at full load and power and at 2,000 meters altitude.

Article VII. An aeroplane capable of carrying a load of more than 600 kilos, a pilot, mechanic and instruments included, although the conditions under articles 4, 5 and 6 are complied with, will be considered a military aeroplane.

(b) Dirigibles

Dirigibles, the cubic content of which exceeds the following, will be considered as military:

1. Rigid dirigibles, 30,000 cubic meters.
2. Semi-rigid dirigibles, 25,000 cubic meters.
3. Non-rigid dirigibles, 200,000 cubic meters.

Article VIII. Factories turning out aircraft shall be registered. All aircraft and pilots, or pilot apprentices, shall be listed in accordance with the conditions provided for in the covenant of October 13, 1919. These lists will be kept at the disposition of the guarantee committee.

Article IX. The stocks of aviation motors, and of spare parts and accessories, shall not be permitted in excess of what will be considered necessary to satisfy the needs of civil aviation. These quantities shall be determined by the guarantee committee.

A revision of the above definitions is contemplated after two years, so that the modifications which the progress of aviation demands may be given consideration.

Personal Par

W. Wallace Kellett, American Representative for H. & M. Farman, has left for the Farman factory in Paris, France. While in Europe, Mr. Kellett will also travel over most of the European Airlines, observing the organization and studying the equipment. His Paris address is care of Morgan Harjes & Company, 14 Place Vendome, Paris, France.

Future Airships Wholly of Metal

In the opinion of Herman T. Kraft, chief aeronautical engineer of the Goodyear Tire and Rubber Company, the airship of the future will be of all-metal construction. This method, he believed, will be of fundamental assistance in the development of dirigibles for worldwide commercial use in aerial transportation. Two factors, it is pointed out, must be considered above all others in the construction of airships of any kind, namely, safety and durability. There must be absolute protection against structural failures as well as against fires. As long as airships are constructed of inflammable materials there will always be some danger of fire, especially with the use of hydrogen gas.

"Uniform distribution of strength," says Mr. Kraft, "which is the major basis of safety, is exceedingly difficult to obtain, even in a rigid airship, because of the very complicated calculations necessary to be sure of safety, since we have to figure unknown factors and allow for them in every airship we build. It will be possible with an all-metal ship to make those calculations much more exact than has hitherto been possible, due to the reduction of the number of small riveted parts, which have formerly been multitudinous.

"The entire surface of the ship will be of metal, thereby assuring greater durability and reduction of fire hazard. Tests have been made which indicate that even hydrogen ignited on the surface of an all-metal container will burn freely without heating up the metal, so that there would be no danger of the envelope being consumed by the flame.

"Unquestionably, the building of such a ship would be a mammoth undertaking, but with the present engineering knowledge available its construction would be entirely practicable. Indeed, it has been attempted before, so far back as two decades ago, and flights were actually made with an all-metal ship with conical ends and cylindrical body, but the ship was not a success, chiefly because engineering knowledge had not progressed sufficiently in aeronautics and proper construction materials were not available."

Mr. Kraft states that aluminum sheeting would doubtless be the metal employed, with strips of very flexible non-inflammable material or wire lacing interposed at various points to take care of the flexing of the envelope while in flight. He also considers that approximately 1,000,000 cubic feet capacity, with a theorctical length of 350 feet and a maximum diameter of about 75 feet, would be the proper size of ship to make to prove its practicability.

"In any consideration of all-metal airships," adds Mr. Kraft, "the question of gas-tight seams has generally been a bugbear, but it has now been conclusively proved that the seams in such a ship can be made gas-tight, especially in a container carrying low pressures. The actual building would be somewhat of a problem, but by using airbags to keep lifting the ship progressively while under construction, and erecting superstructures in the hangars the riveting, lacing and assembling could easily be handled. The rigidity of the structure which would have some degree of flexibility, would eliminate many of the structural difficulties in rigid airships of the present design.

"The first practical all-metal ship will be the key which opens the gates, hitherto barred because of lack of positive assurance of safety and durability, to a real commercial use of the dirigible in air transportation. A striking characteristic of our day is the rapidity with which people accept the marvelous inventions which but yesterday seemed to be the delusions of cranks. We have long ceased to wonder at radio and accept without question every news story of its possibilities. There is every indication that it will be the same with aeronautics with the advent of the first practical all-metal airship, which can be assembled with greater speed.

"Undoubtedly a ship of the construction features pointed out, would practically abolish the dangers from fire and structural breaks, and have all the safety of a modern ocean liner."

Pacific Marine Airways

The Pacific Marine Airways operating H.S.2L. open cockpit 6-passenger seaplanes, are now in active service (commercially), flying from San Francisco Bay. The moorings of the Company are at the Marrina at the foot of Laguna St., San Francisco. The officers of the company are: C. T. Eastman, Pres. and Gen'l. Manager (late Lt. U. S. Air Service; L. Blackner, Secretary and Treasurer and Ron J. Smith, Chief Pilot (late Flying Officer, R. A. F.). The company conducts sight-seeing flights to any desired place over water and instructs in marine flying.

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THE WRIGHT DIRIGIBLE ENGINE AND ITS DEVELOPMENT FOR THE NAVY

By GEORGE J. MEAD

Chief Engineer, Wright Aeronautical Corporation

NOW that the war is over, the general public is apt to forget that preparations for future wars are still a necessity, and that those responsible for the protection of our country are continually working along these lines. In laying out the future development program for the Navy, it was deemed advisable to learn first hand about the advantages of dirigible ships for military purposes. Up to this time our Government had not owned any dirigible ships, and none had been built in this country. The Germans, however, principally through the efforts of the Zeppelin Company, had done a great deal of work with this class of ship, having flown commercially, carrying large numbers of passengers, prior to the war, and some of these same ships were used to bomb England during the war.

The Germans' work left no doubt that the dirigible was practical for certain purposes, particularly long distance flights, such, for example, as one accomplished by the Germans during the war, when a ship was sent to Africa with supplies for some of their troops cut off from communication with the outside world. This ship, upon its arrival at its destination, found the troops captured by the Allies, and, therefore, had to fly back to Germany without landing. This was probably one of the longest single flights that has ever been made. The total mileage covered was in the neighborhood of 4,000 miles.

The American program included the construction of a large hangar at Lakehurst, N. J., and the purchasing of one ship from England, called the ZR-2, and the construction of a similar but somewhat larger ship in this country, by the Navy.

With this program in mind, it was next in order to start the development of some American engines to propel these ships. It so happened that our Company had been considering the advisability of developing this type of engine, and had carefully studied the matter. As a part of this investigation, a single cylinder engine was constructed for the purpose of testing the cylinder construction, which we proposed to use. After carefully reviewing the results of our single cylinder tests and the preliminary design of the proposed dirigible engine, the Navy gave our Company a development contract for three of these engines. This contract was received last June, and it is believed that we have set a record in engine construction by completing the 50-hour test on this engine on March 20, 1922, which meant that the Engineering Department designed the engine, the Experimental Machine Shop built it, and the Dynamometer Room tested it, all within nine months.

About the same time, the Navy Department placed an order with another company for the development of a six-cylinder 300 h.p. dirigible engine. Since this engine was practically identical in size to the Maybach, there was very little doubt that trouble would be experienced in securing a satisfactory engine. In this way, the Navy encouraged the development of two American dirigible engines.

It is perhaps interesting to note how we came to the conclusions, which were reached, in regard to the engine design. The German practice, naturally, was the most modern, and to it we turned in studying the problem. It seemed that the type of engine which they had evolved was a straightforward six-cylinder type, with individual cylinders, the whole construction being simple and durable. These engines were run at comparatively slow speeds, usually between 1200 r.p.m. and 1400 r.p.m. The largest German dirigible engine used during the war, of which we have any knowledge, was the Maybach, which was a 300-h.p. engine, having cylinders approximately 6½ x 7 inches. This engine weighed 921 lbs., or 3.25 lbs. per B.H.P. It is understood that larger engines were being developed, but were not used in service. Since the large dirigibles required considerable power, it had heretofore been necessary to use a number of what are popularly known as "Power-Eggs," or Nacelles, each one carrying an engine. Since the maximum unit powers available were small, there were of necessity a considerable number of Nacelles, each one of which had to have an engineer. This division of power resulted in considerable unnecessary complication and weight. For that reason, it seemed most advisable to endeavor to develop as large a single unit of power as could be safely undertaken with the reasonable assurance of success. Otherwise, we were simply copying what the Germans had done and not developing anything of particular value. This simplified the problem to one of how large a bore was it wise to use.

After a careful consideration of the successful large engines of high power output, it was decided that a 7-inch bore would be reasonably safe, and with an 8-inch stroke we would have an engine capable of developing 400 h.p. at 1400 r.p.m. With such large cylinders, the problem of proper valve and piston cooling became pre-eminent. Very careful design work resulted in developing a cylinder in which the valve cooling was practically ideal, and by the use of a properly proportioned aluminum piston the piston cooling problem was equally well solved. Tests of a single cylinder of this construction showed that it was readily possible to secure a total of 400 h.p. from the completed engine.

The photograph of the engine which accompanies this article gives a very good idea of its general construction. As can be seen from the photograph, the engine is of the six-cylinder, vertical, water-cooled type, with individual cylinders. As already has been mentioned, the bore is 7 inches and the stroke 8 inches, which gives the engine a displacement of 1850 cu. ins. The contract weight for the engine was 1400 lbs., but the engine actually weighs 1320 lbs., which results in a weight of 3.30 lbs. per h.p. Each cylinder is built up with a cast-iron head, to which is attached a steel barrel and water jacket. There are four valves per cylinder, two inlets and two exhausts. These are operated by push rods from camshafts carried in the crankcase, the push rods in turn operating rocker arms, which are mounted on smaller roller bearings. The pistons are aluminum and have 4 compression rings and an oil scraper ring. The connecting rods are tubular in section and have 4 bolts at the big end and a 1¾-inch floating wrist pin bearing in a bronze bushing at the upper end. The crankshaft is a 3-inch diameter shaft, with a bearing on each side of each crank throw. The crankcase is a very deep section aluminum casting, the shaft being supported in the upper case by bearing caps, which are held in position by the through bolts which hold down the cylinders. The case is supported on the bed timbers by extending the double walls of each main bearing through the sides of the case in a box section, the space between the two walls being cored out to provide for the passage of air across and around the main bearings, for cooling purposes. The lower crankcase is made in two sections, and forms an oil sump. These sections are independent of one another and can be removed for inspection purposes. The carburetion is taken care of by two NA-S8 carburetors, made by the Stromberg Motor Devices Co., and each carburetor is attached to an inlet manifold supplying three cylinders. The ignition is supplied by two two-spark six-cylinder Simms magnetos, located at the rear of the engine, firing four spark plugs per cylinder. The lubrication system is full pressure throughout, and oil is pumped directly to all the main bearings, crankpins and wrist pins. The cooling system consists of a large water pump located at the center of the engine, which delivers water across the heads of the cylinders, there being a water outlet at each end of the engine to the radiator. To facilitate the control of the engine, the throttles and instruments are grouped on a control panel at the rear. It will be noticed in the photograph that the oil pumps, oil strainer, oil relief valve and magnetos are located just behind and below the control panel, so that the engineer has practically all the parts requiring attention within easy reach.

The prime requisite of this engine, of course, was durability. It must run long periods without attention. Moreover, should attention be required, the design had to be such that each part was readily accessible without disturbing the other parts. To carry out this idea, individual cylinders were used, and it is, therefore, possible to remove any one of the 6 cylinders. The connecting rods can be taken off the shaft with the engine in position in a Nacelle, so that it is practically possible to inspect and overhaul the engine without removing it from the ship.

We can all be proud of the record which this engine established on its Acceptance Tests. To begin with, it was given an hour's running, one-half hour of which it developed 350 h.p. at 1350 r.p.m., and one-half hour 400 h.p. at 1400 r.p.m. This test was known as the Acceptance Test, and was followed by a 50-hour run of more than usual severity. Forty hours of this run the engine was operated at 1350 r.p.m., developing 350 h.p., and for 10 hours the engine developed 400 h.p. at 1400 r.p.m. No difficulty was experienced in completing this test satisfactorily, and a very unusual record for fuel and oil consumption was es-

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tablished. The average fuel consumption for the whole 50 hours was .475 lbs. per h.p. hour, and the average oil consumption was .008 lbs. per h.p. hour.

Briefly, the Wright Company has succeeded in developing a larger engine than had been used for this service anywhere else in the world in the record time of 9 months, and has made a very satisfactory job out of the first experimental engine. A few very minor modifications were found necessary by these tests to make the succeeding engines entirely satisfactory for their intended work.

The history of this engine is doubly interesting, owing to the fact that it shows in general our procedure in developing a new type. The first step in connection with each new model is to determine the requirements, such as the power, weight and any particular requisites, such as in this case, durability. With this in mind, we endeavor to investigate the cylinder design by building an experimental cylinder and testing it thoroughly. After a cylinder has been satisfactorily developed the final design of the complete engine is undertaken. Following the completion of the design of the engine an experimental model is built in the Experimental Shop and thoroughly tested and developed, so that the following engines of this model produced by the Company incorporate any modifications found necessary in the original design, thus making succeeding engines entirely satisfactory power plants.

In passing, it should be noted that we have established what is probably a new precedent for aeronautical work, in so far as the development of new types of engines go, and that is, that we retain the right to decide whether or not the particular engine which we build satisfies the conditions set up for it. In other words, if, after an engine has been built and tested, we do not feel that it is satisfactory for the service for which it is intended, we will not deliver the engine. What we are trying to sell is the best engine that can be made for each particular service, and we stand behind each engine with a guarantee of satisfactory service. Heretofore most new engines were built for a price, with no particular guarantee as to their performance. The purchaser took a chance on each one. It is not so with Wright engines, as we guarantee a predetermined performance.

Naturally the question arises as to the feasibility of dirigible ships, having so freshly in mind the recent disasters with the ZR-2 and the Roma. Unfortunately, all new engineering work entails a considerable amount of experimental development. It is that period through which we are passing now in the development of dirigible ships. Just as with submarine development work, we are bound to have a certain number of accidents resulting in the loss of life, so it is with airship development work. It is believed that from the experience gained from these two accidents, which were thoroughly and carefully investigated, future disasters of this kind will be eliminated. The successful development of airships of this type will place us in an enviable position as far as air supremacy of the world is concerned. It is, for this reason, worth while to make every effort to thoroughly develop airships, if this is at all possible, and it certainly seems so.

COOLING SYSTEM TEST OF LE PERE P-70 EQUIPPED WITH SIDE RADIATORS

Object of Test

To determine the cooling requirements of the U. S. A. "12" (Liberty) engine when using side radiator.

SUMMARY

The U. S. A. "12" engine rated at 400 horsepower requires 0.625 square feet of cooling surface per rated horsepower for an operating difference of 63° C. between the air temperature and the mean temperature of the engine jacket water. This applies when free air radiators are mounted on the sides of the fuselage and in the propeller slip stream of an aeroplane, climbing at 70 miles per hour and using the U. S. A. "12" engine turning 1,500 revolutions per minute. During level flight at 126 miles per hour and 1,720 revolutions per minute, a temperature difference of 48° C. is obtained with this surface. A temperature difference of 63° C. at 6,000 feet with free air radiators will usually allow full climb at full throttle in ground temperatures of approximately 95° F.

Date and Place of Tests

The tests were conducted June 30 and July 1, 1921, by the Engineering Division of the Air Service under the direction of the Cooling Systems Branch of the Power Plant Section.

General Description

The aeroplane used was a LePere two-seater fighter, Model U. S. A. C. "11," McCook Field No. P-70.

The installation tested is known as the "closed-type" cooling system; that is, it is equipped with a safety valve which prevents overflow until a certain pressure is reached. The cooling system consists of two radiators, one set of shutters for each radiator, shutter controls, an expansion tank, safety valve, and the necessary piping. Complete drawings of the system are listed in Parts List, pages 6271 to 6274, inclusive, 6282 to 6284, inclusive, 6477 to 6480, inclusive, and 6508 to 6518, inclusive.

The radiators are installed, one on each side of the fuselage to the rear of the engine with their front faces perpendicular to the air stream. (See figures 1 and 2.) Their dimensions, determined from actual measurement, are as follows:

Height (over all)	24 ins.
Width (over all)	10¼ ins.
Weight empty (including shutter)	60.5 lbs.
Weight water capacity	27 lbs.
Core height	20 ins.
Core width	10 ins.
Core frontal area each radiator	1.39 sq. ft.
Cooling surface per square feet frontal area of core	90 sq. ft.
Cooling surface each radiator	125 sq. ft.
Total cooling surface both radiators	250 sq. ft.
Cooling surface per h.p. at 400 h.p.	0.625 sq. ft. per h.p.

The radiator core is the U. S. standard type, made of seamless round copper tubes, 9 inches long, with expanded hexagonal ends, corresponding to A. S. drawings Nos. M-1318 and M-1337.

The radiators are bolted to the fuselage through shock-absorbing rubber pads and steel brackets.

The shutters are of the vertical vane type and consist of six vanes for each radiator. The vanes have a stream-line form, as shown in A. S. drawing X-29304. They are 2 inches wide by 19⅞ inches long. An attempt was made to decrease the head resistance of the radiators when the shutters were closed by slanting them, so that the plane of the closed shutters makes an angle of 30° with the face of the radiator. The slip stream is therefore deflected 60° instead of 90°, as would be the case if the shutter were parallel to the radiator face.

The shutters are controlled by push rods and bell cranks connecting to a conventional type control lever in the cockpit.

The expansion tank is mounted on the leading edge of the top wing center section. It conforms to drawing No. X-29573. Its weight and capacity are as follows:

Fig. 1

Fig. 2

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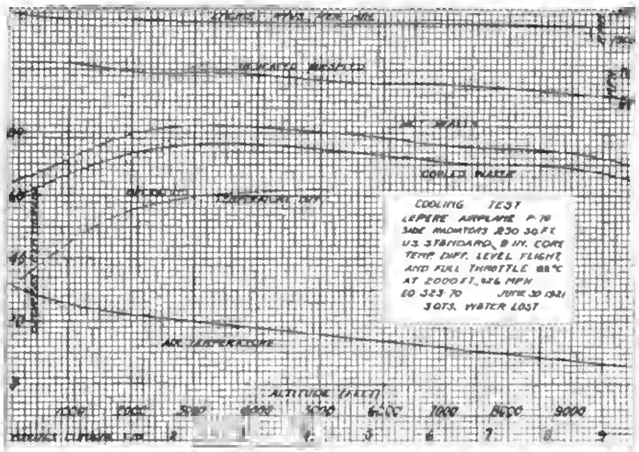

Fig. 3

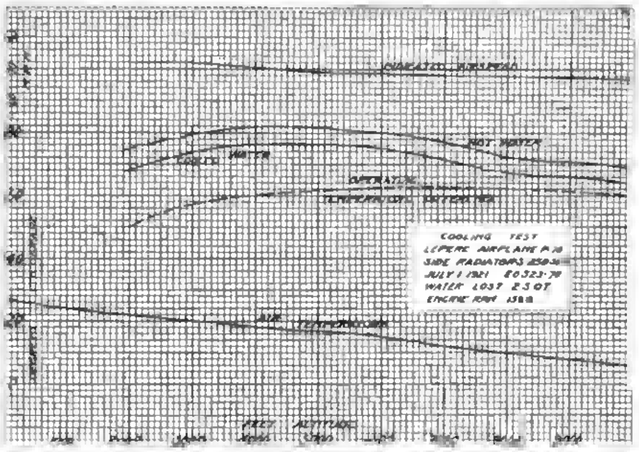

Fig. 4

Weight expansion tank empty.............. 13 pounds
Weight full of water....................... 38 pounds
Water capacity .... 3 gallons

A filler neck and cap of stream-line form is fitted to the expansion tank. Two Lunkenheimer air-pressure relief valves are provided in this cap to allow the water to overflow when a pressure of 3 pounds per square inch is reached. The water which overflows through the relief valves is carried through a ⅜-inch diameter overflow pipe to a convenient point at the side of the fuselage, where it is discharged.

The water piping is arranged so that water leaving the top of the engine goes to the expansion tank. Two pipes from this tank direct the water down each front center section strut to the radiators. The water leaving the radiators enters the engine water pump.

The engine exhaust manifolds are arranged to direct the hot exhaust gases away from the radiator.

For the purpose of the test a Boyce distance-reading thermometer, indicating the temperature of the water after it had been cooled by the radiators, was provided, in addition to the thermometer ordinarily supplied to indicate the temperature of the hot water leaving the engine. A strut thermometer was also installed which showed the temperature of the air through which the aeroplane was flying.

Description of Tests and Results

The tests were conducted in the usual manner. The aeroplane was flown at full throttle and full climb until positive cooling of the water in the system occurred. Full-throttle level flight tests were also made at altitudes of 10,000, 8,000 and 2,000 feet. The data obtained is shown in the following tables:

During the climb it will be seen from the following tables and curves (Figs. 3 and 4) that the maximum temperature of the water was reached at an altitude of approximately 4,000 feet. The maximum difference between the air temperature and the mean temperature of the jacket water was reached at approximately 6,000 feet and was 63° C. During level flight at 2,000 feet the difference between the air temperature and the mean temperature of the water in the engine was 48° C.

This performance normally allows full climb at full throttle, without boiling the water in the cooling system, with maximum ground temperatures of approximately 35° C. to 40° C. or 95° F. to 105° F., when the rate of temperature decrease with altitude is equal to that occurring during these tests. This is satisfactory according to Air Service requirements. It will also allow full-throttle level flight at 2,000 feet altitude without boiling, when the ground temperature is 45° C. or 112° F.

It is to be noted that the maximum operating temperature difference in each of the climbs was practically the same; that is, 63° C. It does not follow that the maximum ground temperature at which the aeroplane can be climbed without boiling is also a constant figure. If the hot-water temperature at the time of take-off had been 95° C. on either of these tests, instead of approximately 62° C., the maximum ground temperature in which full throttle full climb could be made would have been 29° C. or 85° F.

Assuming 6° C. temperature drop between water entering and leaving radiator

$$\frac{95 + 89}{2} = 92° \text{ C. mean jacket water temperature.}$$

92 — 63 = 29° C. or 85° F. maximum allowable ground temperature.

The maximum allowable ground temperature is also affected by the rate of temperature decrease with altitude.

The surface per horsepower furnished is $\frac{250}{385} = 0.65$ square foot per horsepower, based on 385 horsepower and 70 miles per hour air speed during climb at 1,560 revolutions per minute of the engine. This applies when the free air radiators, using the U. S. standard 9-inch core, are used and when the air-flow conditions are similar to those occurring on the aeroplane tested. Based on the rated horsepower of 400, the surface provided is 0.625 square foot per horsepower.

The water-flow capacity of the radiators was tested. A curve of the results is shown in Fig. 5. This is satisfactory and exceeds the requirements of the engine.

The shutters are very effective and allow a wide range of temperature control. The effect on the aeroplane performance of slanting the plane of the closed shutters toward the fuselage is not known.

Cooling Test on LePere P-70

Date, June 30, 1921. Hour, a. m. E. O. No., 523-70.
Pilot Lieut. Kelley. Propeller, 36167. Barometer, 29.208.

(*Concluded on page 352*)

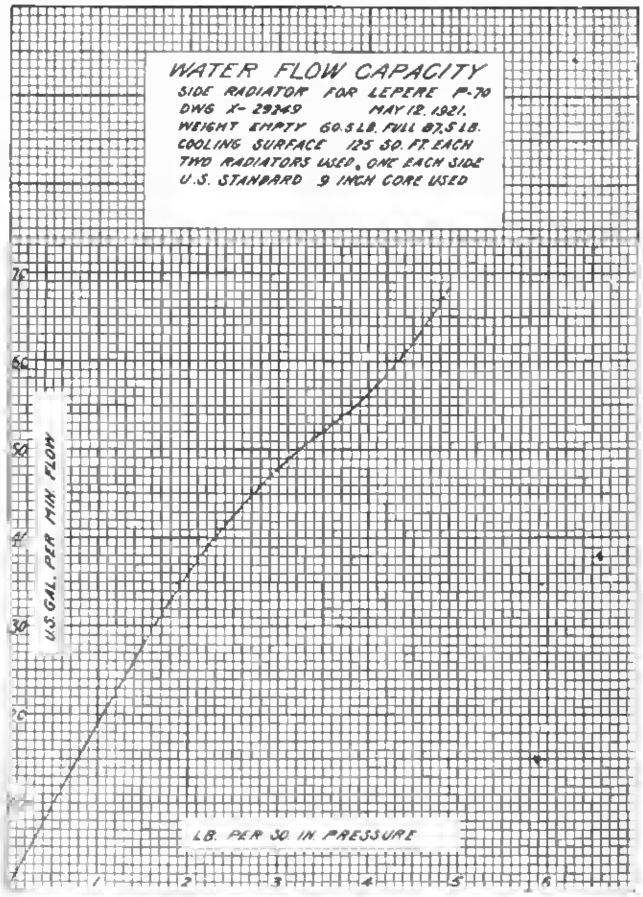

Fig. 5

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COMMERCIAL AVIATION

[*The following article is an excerpt from the 1922 Aircraft Year Book shortly to be published by the Aeronautical Chamber of Commerce of America.*]

IN aviation the year 1921 is marked by three outstanding events, one of universal and epochal importance.

During June and July there were held, 100 miles off the Virginia Capes, a series of experiments in the course of which aircraft flown from land bases, bombed and sank, one after the other, a submarine, destroyer, light cruiser and dreadnought, the most modern examples of warship construction.

In the fall the Conference on the Limitation of Armament was held in Washington, and it was asserted that the bombing tests cleared the way, more than any other single event, for a possible solution of the international competition in capital ship construction. For the 2,000-pound TNT bomb which crushed in the steel walls of the "Ostfriesland" was, as the Army Chief of Ordnance remarked at the moment, "heard around the world."

Commercial aviation, struggling for nearly three years without assistance of a national policy, found an intelligent and sympathetic friend in the Harding administration. The President in his inaugural address urged the early enactment of an Aerial Code and the consistent encouragement of civilian flying. In consequence there was drafted a bill regulating the operation of aircraft in interstate and foreign commerce; and establishing a Bureau of Civilian Aeronautics in the Department of Commerce. This bill, introduced by Senator Wadsworth, passed the Senate, and at the time of publication of this volume was before the House Committee on Interstate and Foreign Commerce.

Possibly the most definite proof of growth in interest in commercial aviation was the establishment, late in the year, of the Aeronautical Chamber of Commerce of America. The need for such an organization had long been felt. With definite assurance that an Aerial Code would shortly be established, manufacturers of heavier- and lighter-than-air craft, motors, parts, accessories, materials and supplies; dealers, distributors, operators and owners; associations, corporations, firms and individuals engaged in the commercial phases of the art, decided to equip themselves with a national organization of the type which had proved so useful in the development of other American industries.

The Aeronautical Chamber of Commerce was incorporated under the laws of the State of New York "to foster, advance, promulgate and promote" aeronautics, and "generally to do every act and thing which may be necessary and proper for the advancement" of American aviation. Formal organization was announced on December 31, 1921, with a charter membership of 100. At the time of publication membership had increased to 175, including such pioneers as Orville Wright and Glenn H. Curtiss, and embracing practically every important aircraft manufacturing unit in the United States.

Commercial aircraft in 1921 definitely began the demonstration of practical utility. The business man who, in 1919, was merely curious, and in 1920 was interested, became convinced, in 1921, that aerial transport was no longer fancy but fact. More miles were flown, more paid passengers booked and more package freight and goods carried.

Comparative Commercial Aircraft Operations, 1920-1921

	1920	1921
Estimated number of aircraft in operation	1,000	1 200
Estimated total mileage	6,000,000	6,250,000–6,500,000
Operating companies reporting	88	125
Equipment of these companies	365–425	500–600
Mileage flown by these companies	3,136,550	*2,907,245
Number of passengers carried	115,163	122,512
Pounds of freight carried	41,390	123,227
Number of flights by operating companies	Unknown	130,736
Average duration of flights	Unknown	21 minutes
Average charge for short flights	$12.50	$9.00
Average charge per mile for inter-city flights	.65	.55
Average charge per pound for freight	Unknown	.55
States in which operations were carried on	32	34
Air terminal facilities	128	146

The foregoing is believed by the Aeronautical Chamber of Commerce to be accurate. The census of craft, in the absence of Federal law requiring registration, is based upon the statements of 125 established operators, upon Air Service and Naval Estimates, and upon the personal observations of representatives of the Chamber throughout the country. The 1,200 craft in operation represent an increase of 20 per cent over the figures for 1920, and, generally speaking, this percentage of increase is noted throughout.

Approximately one-half the equipment was controlled by established organizations, the other half being in the hands of the gypsy flier, the care-free and often too-careless itinerant, whose wanderings from Coast to Coast and from Mexico to Alaska, have done a certain amount of good but probably much more harm. It being known that the operators at fixed points covered approximately 3,000,000 miles, carrying about 122,500 passengers, it is estimated that, all told, rather more than 250,000 persons flew and that, counting the wanderings of the gypsy, 6,500,000 miles were compassed by commercial aircraft during the year.

The most valuable service which aircraft provide is speed. Conjoined with this is their unique ability to operate independently of land of water, dominating both in time of war, and capable of adaptation in time of peace to a multitude of novel uses limited only by ingenuity and commercial and industrial needs.

The following visualizes the service of the airplane and airship:

National:—National Defense (Army, Navy, Marine Corps) Air Mail; Forest Patrol; Coast Guard; Customs and Revenue Service; Agricultural Survey; Coast and Geodetic Survey; Scientific Observation; Warning and Relief in Disaster.

Civic:—City Planning; Road and Building Construction; Rail and Water terminal problems; Fire and Police Zoning; Park Improvement.

Commercial:—Passenger Service; Freight Transportation; Messenger Service in Banking; Surveying—Engineering; Aerial Photography; Collection and dissemination of News; Advertising and Publicity; Sport and Pleasure; Commuting.

"Commerce Demands Speed; Flying is the Answer," is the timely and more original trade phrase being urged by the operators. "Less Waste, More Speed," is the reply which Commerce makes, through Samuel M. Felton, president of the Chicago Great Western Railroad, and during the war Director-General of Transportation for the A. E. F.

The aeroplane man, alive to what is undoubtedly the most vexing of all contemporary business problems, conceives the greatest commercial need to be swifter dispatch. The railroad man, equally conscious of the need, but schooled with practical experience, demands economy. This is the challenge to commercial aircraft and it is significant of the immediate future that, in 1921, improvement in construction, decrease in operating costs and increase in the factor of safety and reliability, went far toward establishing the commercial aerial transportation business upon a sound financial basis, with but one thing lacking, and that about to be provided—the enactment by Congress of an Aerial Code.

Commerce is the same in principle, whether carried on in a thickly populated territory, well equipped with the most improved means of transportation, or whether in sparse regions poorly served, if at all, by conveyances on road, rail and water. Commerce is satisfactory only when conducted with dispatch, and there are circumstances and conditions under which commerce will gladly pay an increased tariff for increased speed.

The correctness of this statement is apparent upon the analysis of the following table showing aircraft operations by states:—

State	1920	1921	Increase	Decrease
Alabama	1	0	—	1
California	8	10	2	—
Colorado	3	1	—	2
Connecticut	1	1	—	—
Florida	3	3	—	—
Georgia	2	0	—	2
Idaho	0	1	1	—
Illinois	2	8	6	—
Indiana	7	1	—	6
Iowa	3	4	1	—
Kansas	0	6	6	—
Kentucky	0	1	1	—
Louisiana	1	1	—	—
Maine	0	1	1	—
Massachusetts	1	3	2	—

* Decrease explained by less free and more paid flights.

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Minnesota	2	2	—	—
Missouri	1	6	5	—
Montana	0	2	2	—
Nebraska	0	3	3	—
Nevada	0	1	1	—
New Jersey	4	5	1	—
New Hampshire	1	1	—	—
New Mexico	1	0	—	1
New York	9	15	6	—
North Carolina	2	0	—	2
North Dakota	0	1	1	—
Ohio	7	6	—	1
Oklahoma	2	5	3	—
Oregon	3	1	—	2
Pennsylvania	1	4	3	—
South Carolina	0	1	1	—
South Dakota	1	5	4	—
Tennessee	1	0	—	1
Texas	2	12	10	—
Utah	1	0	—	1
Vermont	2	1	—	1
Virginia	1	2	1	—
Washington	7	6	—	1
West Virginia	0	1	1	—
Wisconsin	3	3	—	—
Wyoming	2	0	—	2

States Operated in 1920—32
States Operated in 1921—34
States Showing Decrease in Operations—13
States Showing Increase in Operations—22
(Note:—Canada reported in 1920 but not in 1921).

The greatest growth in commercial aerial transport has been in those parts of the country where the volume of traffic requiring rapid transit is such as to choke available surface facilities or where, surface facilities being antiquated, available traffic seeks other means of movement. In both cases Commerce willingly pays a premium.

The table showing operations by states illustrates that the pressure upon surface facilities in Illinois, Massachusetts, New Jersey, New York, Pennsylvania, etc., has encouraged the establishment of eighteen new aircraft operators, all of which engage in occasional transport between cities, but which are handicapped in their endeavors to establish regular service, by the absence of landing facilities, properly disseminated weather reports, and Aerial Law which is primary to the legitimate general capitalization.

In California, Idaho, Iowa, Kansas, Kentucky, Maine, Missouri, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Virginia, and West Virginia, where distances are great and surface facilities backward, commerce is willing to utilize aircraft. For the same service which appeals to the great business establishments of New York or Chicago, eager to hasten delivery and speed collection, appeals likewise to the small community the progress of which manifestly rests upon the rapidity with which it releases itself from isolation and establishes quick contact with purchasing territory hitherto unattainable.

STANDARDIZATION AND AERODYNAMICS

By E. B. WOLFF

Director Rijks-Stodienst voor de Luchtvaart, Amsterdam, Nederland

The discussion brought up by William Knight in The Aerial Age of June 20th, 1921, on "Standardization and Aerodynamics" has given rise to a very interesting expression of the views on this subject of the most important aerodynamical laboratories in Europe (see previous issues of Aerial Age, article by Prof. Prandtl, October 3rd, 1921; article by Prof. von Karman, January 2nd, 1922; article by Col. Costanzi, February 20th, 1922; article by W. Margoulis, March 6th, 1922; article by Col. Verduzio, April 3rd, 1922; and article by Dr. Katzmayr, May 8th, 1922). I think I should state what is the stand taken by the Rijks-Studiedienst voor de Luchtvaart on the matter of Standardization of graphical methods of representation of results of tests made in aerodynamical laboratories, standardization of symbols and coefficients used in technical aeronautical publications in various countries, etc.

The desirability of reaching an international agreement on this very important matter, as suggested by Wm. Knight, has already been voiced in The Aerial Age by eminent scientists and aeronautical experts and, in my estimation, as well as in the estimation of Dr. C. Koning and Dr. A. G. Baumbauer of the Section for Aerodynamical Tests of our Institute, we must express our solidarity with the idea of international scientific cooperation in aeronautics which has been championed by Wm. Knight, with whom we have already discussed several times this matter during the last few years while he was the Technical Assistant in Europe to the U. S. National Advisory Committee for Aeronautics.

It seems to us that it should not be difficult to come to an agreement on this point, as the importance of standardization in aerodynamics will be granted by all aerodynamical experts and the change from the system originally used by a laboratory to the one that will be adopted as the international standard system will not offer serious difficulties. Moreover, a discussion on these questions may be a welcome introduction to further international cooperation and understanding. An aerodynamical coefficient which stands at the present time in great need of standardization is the coefficient *vl* (Reynolds' number) for model tests. Considering the diameter and the maximum velocity of the existing wind tunnels, it would perhaps be possible to divide them in groups, each group making routine-tests at the same value of *vl* (such as tests on wing sections and aeroplane-models) in order to make the results of these tests comparable with each other, without any corrections for scale-effect.

TABLE I

Wind Tunnel	V in M/sec	D in M	VD in M2/sec
N. P. L. 4 ft.	15	1,22	18,3
N. P. L. 3 ft.	21	0,91	19,1
Massachusetts Institute of Technology	29	1,22	35,4
N. P. L. 7 ft. Nr. 1	20	2,13	42,6
N. P. L. 7 ft Nr. 2	26	2,13	55,4
Rijks-Studiedienst voor de Luchtvaart (Holland)	35	1,60	56,0
Eiffel (Auteuil)	30	2,00	60,0
Tokio (Marine)	30	2,00	60,0
Saint Cyr	40	2,00	80,0
McCook Field	235	0,36	84,6
Istituto Sperimentale di Aeronautica (Rome)	50	2,00	100,0
Göttingen	50	2,24	112,0
Luftschiffbau Zeppelin	50	3,00	150,0
Dayton	67	2,50	167,5

In TABLE I the values of V (maximum velocity) in meters per second, those of D (diameter or side of the square of the working portion) in meters, and the product VD are tabulated for some of the existing wind tunnels. The product VD is the deciding factor of the maximum value of *vl* at which tests can be made. This table shows that there are a number of wind tunnels for which the values of VD show only small differences.

Comparative tests in the different wind tunnels is another important aspect of the proposed international cooperation.

Although we have at the time joined Wm. Knight in his effort to bring about a comparison of results of model tests on standard-models in different laboratories, we should like to point out some difficulties which will perhaps make it desirable to introduce some slight changes in the comparative tests program now under consideration when one or two models are successively tested in the wind tunnels of different laboratories, as has been proposed values found for the lift, drag, etc., will not be the same. The question will then arise, what is the reason for the differences and which value must be considered as the true one?

The differences found may be caused by the following factors, which can be arranged under three main headings:

First, there are errors caused by the method of measurement of the forces. Here we must mention the interference of suspension members with the flow past the model, and the correction needed for the forces acting on the parts of the weighing apparatus projecting into the wind stream, and also errors of the weighing apparatus itself and errors due to the instruments used for measuring the air velocity.

Second, the influence of the boundaries of the air-stream upon the results.

Third, the differences which are due to the nature of the air-stream itself—irregularities of the velocity of the air-stream

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in different parts of the cross section and in regard to time, turbulence of every kind and variations of static pressure. It seems to us that it would be greatly desirable to separate errors caused by these three groups of causes in order to reach a sound comparison of wind tunnel characteristics, and this can be done by pursuing the following experimental program:

1. Experiments on the different methods of suspension of models and a critical study of the different kinds of weighing mechanisms and velocity measuring devices used by the various laboratories.
2. Experments and theoretical investigation of the influence of the finite dimensions of the air-stream.
3. Experiments on the influence of irregularities of the flow and of turbulence around different kinds of models.
4. A thorough exploration of the air-stream of the wind tunnels as to turbulence, regularity of the velocity and variation in static pressure.

The experiments listed under 1, 2 and 3 need not be carried through in every wind tunnel. This part of the work can be done by laboratories, which are best fitted for this work and dispose of different wind tunnels so that their ordinary work is not too much retarded by these long systematic tests. Some of this work has already been done[1]. Only the experiments mentioned under 4 need to be done in every existing wind tunnel.

The results of a comparison of this kind will be that an intimate knowledge will become available of the inherent quality of the air-stream of each laboratory. When, from the tests grouped above under 1, 2 and 3, we shall have learned the influence of the different factors upon the results of the tests, it will be possible to draw conclusions about the exact meaning of such tests.

A program, as set forth above, will necessarily take a great deal of time; but it seems to us that such a program would not be too much of a burden on the laboratories and would lead to a knowledge of the actual conditions under which research work is carried which will be of great help to the progress of the scientific end of aeronautics.

However, it is desirahle to have without further delay some preliminary base of comparison, and for this reason the adoption of a preliminary limited program of investigation as suggested by Wm. Knght would be acceptable to us.

The superintendant of the aerodynamical section of the National Physical Laboratory in Teddington informed us that he is actually experimenting on some models prior to the circulating of them through the different laboratories which are willing to make the necessary experiments, and we are awaiting with interest the materialization of this preliminary form of international cooperation in scientific work, which we hope will become more intimate and effective as the time goes on.

[1] See articles:

On the influence of the suspension parts:
Robert—Utilisation des résultats des essais. Rapports du Premier Congres International de la Navigation Aérienne. Tome I, p. 1.

Preliminary experiments on the effect on the experimental results of the method of suspending the model in aerodynamie measurements. Verslagen en Verhandelingen van den Ryks-Studiedienst voor de Luchtvaart, Amsterdam. Deel I, p. 54.

Irving, H. B., and Jones, C. N.—Note on the form and resistance of the spindle used by the N. P. L. for standard tests of 18" x 3" aerofoils. R. & M. 418. Advisory Committee for Aeronautics.

On weighing mechanisms:
Warner, E. P., and Norton, F. H.—Wind tunnel balances. Report No. 72. National Advisory Committee for Aeronautics.

On the influence of the boundaries of the air-stream:
Prandtl, L.—Tragflügeltheorie II. Nachr. von der Kön. Ges. d. Wissensch. zu Göttingen, p. 123.

Prandtl, L.—Applications of modern hyrdrodynamics to aeronautics. Report 116. National Adv. Comm. for Aeronautics, p. 51.

On the influence of turbulence:
Wieselberger, C.—Der Luftwiderstand von Kugelen. Zeitschrift f. Flugt. u. Motorluftsch. f. 1914, p. 140.
Relf, E. F., and Lavender, T.—The effect of upwind disturbances in the air current of the channel upon the forces on models, with special reference to the effect on the drag of an airship model. R. & M. 597. Advisory Committee for Aeronautics.

On the influence of the fall of static pressure:
Horizontal buoyancy in wind tunnels. Technical Note 23, National Advisory Committee for Aeronautics.

[2] Part of this work has been done, too, we have published our results regarding velocity-distribution in the wind tunnel of the Ryks-Studiedienst voor de Luchtvaart: "Verslagen en Verhandelingen van den Ryks-Studiedienst voor de Luchtvaart", Deel I, 1921, p. 11. We presume that a great deal of unpublished results obtained in other tunnels could be collected.

THE CHOICE OF AIR ROUTES

By EDWARD P. WARNER

Professor of Aeronautics, Massachusetts Institute of Technology*

A CASUAL inspection of the air-travel map of Europe suggests to the layman but little attempt at a careful determination of the location of the routes operated. Criss-crossing back and forth across the continent and seeming to have been laid down haphazard, they give no superficial indication of the application of analysis to their choice.

There are, nevertheless, certain rules with which the location of all commercial air lines should be in accord. Those rules have in general been followed in Europe as they must be followed here, although the peculiar form of some of tbe governmental subsidies has led to the development in the Eastern hemisphere of a few lines whose merit is political rather than economic. Certain countries, for example, offer exceptional inducements for the promotion of lines running from the country to its colonies and dominions.

It is not without significance, and it was not the result of accident, that the three big flights carried out in the last three years by British aircraft have been from the British dominion of Newfoundland to the Irish coast, from London to the British dominion of Australia, and from London to the British dominion of South Africa. It is not without significance also that one of the most notable French cross-country enterprises was the flight of Commandant Vuillemin from Paris to Dakar in French West Africa, crossing French Morocco and the French Sahara on the way. The governments all realize the great possibilities of the aeroplane as a means of accelerating communication and tightening the bond between the mother country and her dominions.

Aeroplanes in India

The air map of Central Europe, too, is somewhat distorted by the provisions of the International Air Navigation Convention, under the terms of which there is no direct aerial communication between the territory of the principal allied powers and that of their late enemies. Travel between Paris and Berlin, for example, must be carried on by way of Amusterdam, changing from a French to a Dutch or German aeroplane at that point.

The political factor in the determination of flight routes may be even more marked within the next few months than it has in the past, for the report comes from Berlin that there are threats from certain German sources of a permanent aerial boycott against the allied powers unless the restrictions on German aircraft construction and traffic are relaxed.

Only by brushing aside such extraneous considerations as these can he arrive at the economic fundamentals of the problem. First among those fundamentals is that the aeroplane with its relatively high costs can compete most effectively with established means of transport where those means of transport are slow, uncertain, or inconvenient. It is for this reason that the aeroplane has come into such extensive use as a regular means of transport for official travelers in certain countries less developed than our own. In Haiti and San Domingo, for example, it is reported that the aeroplane is in regular use by high officials of the American Marine Corps administration in order to get from one part of the islands to another. In the East, similarly, the British have found it invaluable for transport in Palestine and Mesopotamia. In fact, the play in which George Arliss is now appearing in Boston, "Tbe Green Goddess," is based on the events which grew out of such a use of the aeroplane by British officials in India. Where the only previously existing means of travel was by camels or other riding animal tbe aeroplane cuts the time required for a journey by fully 90 per cent. Obviously, under such conditions the advantages of air transport shine brighter than they do when it must compete with the Knickerbocker Limited or the Twentieth Century.

One of the most notable examples of a route which runs through a highly developed country and which connects great centers of industry and population, and on wbich the existing means of transportation are so inconvenient as to offer a great advantage to the aeroplane, is the line connecting London and Paris. The traveler who has once been through that journey by ordinary means, with its two changes of vehicle, with a channel crossinig which seems to try to live up to the worst things that have ever been said of any sea voyage, and with its multiple examination of baggage, will be anxious to use air transport or

* Taken from *The Christian Science Monitor.*

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WAR DEPARTMENT

June 19—*Q. M. SUPPLIES*—Camp Sherman, O., Auction. For catalog write, Gen. Intermed. Depot, 1819 W. Pershing Rd., Chicago, Ill.

June 22—*Q. M. SUPPLIES*—Boston, Mass., Auction. For catalog write, C. O., Q. M. Intermed. Depot, Boston.

June 27—*Q. M. SUPPLIES*—Norfolk, Va., Auction. For catalog write, Q. M. S. O. Gen. Intermed. Depot, 1st Ave. & 59th St., Brooklyn, N. Y.

June 29—*Q. M. SUPPLIES*—Brooklyn, N. Y., Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, 1st. Ave. & 59th St., Brooklyn.

June 29—*AIRPLANE ENGINES*—Washington, D. C., Sealed bid. For catalog write, Chief, M. D. & S. Sect., 2624 Munitions Bldg.

July 6—*Q. M. SUPPLIES*—San Antonio, Tex., Auction. For catalog write, Q. M. S. O., Ft. Sam Houston, Tex.

July 7—*Q. M. SUPPLIES*—Washington, D. C., Auction. For catalog write, Q. M. S. O., 1st Ave. & 59th St., Brooklyn, N. Y.

July 11—*AIR SERVICE SUPPLIES*—Buffalo, N. Y., Auction. For catalog write, C. O., Curtiss-Elmwood Depot, Buffalo, N. Y.

July 12—*Q. M. SUPPLIES*—San Francisco, Calif., Auction. For catalog write, Q. M. S. O., Gen. Intermed. Depot, Ft. Mason, San Francisco, Calif.

July 13—*Q. M. SUPPLIES*—Omaha, Neb., Auction. For catalog write, Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

July 18—*Q. M. SUPPLIES*—Chicago, Ill., Auction. For catalog write, Q. M. S. O., 1819 W. Pershing Rd., Chicago, Ill.

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SELLING PROGRAM

In checking over the accompanying program of sales, note that the designation "Q.M. SUPPLIES" is a cloak to a list of 65,000 commodities. Not all of this great number is included in each sale, of course. Nor will the manufacturer and dealer in the aero field be interested in all of the 65,000 items. Your individual needs govern your purchases. Catalogs of each sale will guide you to wise buying.

Sales listed as "AIR SERVICE SUPPLIES" will present some or all of the following commodities:—

Planes and parts; motors and parts; linen and cotton fabrics; scrap steel, iron, bronze, aluminum and brass; helmets, goggles, flying suits and leather coats; oils and lubricants; cameras, kodaks, lenses, chemicals, compasses, stop-watches, clocks, propellers, welding outfits, etc.

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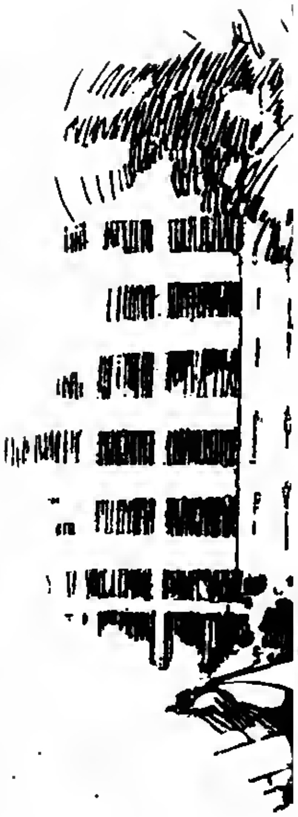

By Negotiation

During July and August, at Chicago, Ill., the War Department is conducting one of the greatest sales of machine tools it has ever held. A great variety, and large quantities of machines are offered. Send for full information to Chairman, Chicago District Ordnance Salvage Board, 7400 South Ashland Ave., Chicago, Ill.

The Government reserves the right to reject any or all bids

WAR DEP

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Better Business

Your hand can dam the mighty Mississippi at its source. Lift your hand, and the labors of a nation cannot halt the majestic sweep of the waters near their mouth.

Business is like the Mississippi. Remove the barrier at the source of supply, and the stream of trade will grow in volume as the rivulet becomes the river.

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ARTMENT

anything else which enables him to avoid those manifold inconveniences in future. A considerable part of the London-Paris passenger traffic is made up of people who travel by air for greater comfort and convenience than they can obtain by land and sea, and some part at least of the express business comes from shippers of fragile or perishable articles desiring to avoid the heavy handling whicb those are likely to receive by transshipment at the channel and during customs examination. Millinery, eggs and flowers have been among the articles frequently shipped by air between the two capitals. In general, the same considerations that make the London-Paris route supremely excellent for exploitation by air will apply to any journey combining land and water transport, or crossing deserts or mountains, where the volume of traffic is not large enough to justify the great expense of good railroad construction. There would be a distinct field for aeronautics from this source in some of our western states and in the Great Lakes district.

In the Texas Oil Fields

Obviously, the second requirement for an air route is that the traffic must exist, and it must be a relatively wealthy traffic willing to pay for high-speed transport. The quantity need not be large, but the economic quality must be high. These conditions are, of course, most readily satisfied between great cities, where, however, there is likely already to be excellent train service between cities and summer resorts at a considerable distance and patronized primarily by the wealthy, and in recently opened districts of great mineral wealth. There have probably been more privately owned aeroplanes employed in connection with the oil industry in the recently developed Texas fields than in any other one way in this country. Speed in locating and developing a source of mineral wealth and taking advantage of the opportunities which appear is all important.

Another requirement, and the last of the very important ones, is that the route must be such that flying will be safe. It is not safe to cross large bodies of water with a land aeroplane. It is not safe to pilot an aeroplane over extensive swamps or forests or deserts or over any other country where the danger of wrecking the aeroplane in a forced landing would maroon the passengers far from the haunts of men. This requirement of good and safe landing places is, unfortunately, often in conflict with the first requirement of a country in which railroads do not operate effectively, and they can only be reconciled by the provision and upkeep of numerous landing places in the undeveloped regions. Tbe British Government has done tbis, for example, in laying out the route from Cairo to Cape Town, with cleared landing fields at reasonably short intervals, most of them offering an opportunity for the obtaining of supplies of various sorts and some being fully equipped airdromes with mechanical assistance available if needed.

Need of Landing Fields

Air transport cannot develop to a high degree, even in the United States, until some steps are taken to provide fields along the route for use in case of emergency. Furthermore, there must be landing fields near the cities. At the present time it takes one and three-quarter hours to fly from the Boston airdrome in Framingham to the New York airdrome in Mineola. To go from Boston to Framingham consumes an hour, and 45 minutes more is lost in getting from Mineola to New York City. The total time, therefore, is just double what is would be if flying fields were available close to each city, and any city which has a piece of undeveloped land in a position where a flying field can be established within a few minutes' ride of the business district should declare itself thrice blessed and seize the golden opportunity without further delay. In the light of two and one-half years' experience in commercial operation of aeroplanes between London and Paris, it is hard to place an estimate on the value that a landing field close to the center of London would have or to guess the increase in traffic which would result from the elimination of the tedious automobile journeys from London out to Crydon and from Le Bourget into Paris.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, April, 1922

DIVISION	Gas	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gas	Total Time Run Hr.	Min.	Total Miles Run	Cost per Hour	Cost per Mile
EASTERN New York-Chicago.....	$3,314.81	$673.69	$814.76	$1,741.41	$1,094.27	$724.42	$3,040.60	$1,305.15	$4,274.15	$4,135.34	$1,567.31	$819.26	$23,505.17	11,569	426	26	39,501	$55.11	$0.60
CENTRAL Chicago-Rock Springs	4,296.53	845.12	2,033.34	2,060.85	896.56	644.53	3,489.02	1,890.21	5,781.06	3,673.77	2,269.90	1,186.50	29,067.39	15,581	623	48	55,914	46.60	.52
WESTERN Rock Springs-San Francisco	3,175.11	560.52	4,797.58	1,396.25	902.36	557.14	3,408.62	1,305.15	4,180.03	4,824.16	1,567.31	819.26	27,493.49	10,660	403	39	38,588	68.11	.71
Totals and Averages.....	$10,786.45	$2,079.33	$7,645.68	$5,198.51	$2,893.19	$1,926.09	$9,938.24	$4,500.51	$14,235.24	$12,633.27	$5,404.52	$2,825.02	$80,066.05	37,810	1,453	53	134,003	$56.06	$0.60

Total Operating Cost..............................	$80,066.05
Permanent Improvements..........................	1,396.25
Grand Total............................	$81,462.30

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern..........................	$0.19	$0.21	$0.20
Central..........................	.15	.20	.17
Western..........................	.19	.21	.32
Entire Service..........	$0.17	$0.21	$0.22

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Heat, Power, Telephone and Water; Radio.
Flying consists of: Gas; Grease and Oil; Pilots.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

PAUL HENDERSON, Second Assistant Postmaster-General.

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NAVAL and MILITARY AERONAUTICS

Dedication of Shoen Field

Under the auspices of the 464th Pursuit Squadron, Organized Reserves, the 100-acre tract used as a flying field at Fort Benjamin Harrison, Ind., was dedicated to the memory of Lieut. Carl Schoen on Sunday, May 7th. Lieut. Shoen was an Indianapolis boy, and at the time he was shot down in 1918 he had been credited with seven enemy airplanes. In his last combat he was engaged with a superior number of the enemy. Mrs. Schoen, his mother, was present at the ceremony.

All roads and available space around the field were jammed with the parked cars of the spectators. The crowd surrounded a flag-draped Martin Bomber Transport. The nose of this ship was used as a speaker's platform. Major-General George W. Read, Fifth Corps Area Commander, made an appropriate talk and then introduced Judge Robinson, of Indianapolis, who recounted the life and deeds of Lieut. Shoen and the debt Americans owe to him and his comrades who, through their supreme sacrifice, have shown the way to one hundred per cent Americanism.

Immediately following the program of speeches, there was a battalion parade by the 11th Infantry troops and band stationed at Fort Benjamin Harrison. They passed in review before General Read, Judge Robinson, Mayor Lew Shank and officials of Indianapolis, and the members of the 464th Squadron, who were in uniform.

The spectators were then taken in hand by the Reserve Officers and shown the different planes. The DeHavilands and Curtiss offerings received scant attention because the big Martin "U. S. Transport" began to warm up for the return flight to McCook Field, piloted by its skipper, Lieut. Wade. The day was perfect for flying. Under the leadership of Major Maxwell Kirby, four ships were warmed up, and all members of the Reserve Squadron were given rides. Later on several of them were allowed to solo. For about two hours the field resembled a hive of huge bumble bees, planes alighting and departing, circling and soaring, while they were followed with interest and apprehension from the ground.

Due to the efforts of Major Kirby and a Committee of Reserves, all planes went through with well-oiled smoothness. There was no suggestion of a mishap in flying. The day was a great success from every standpoint. The people were acquainted with the fact that there will be flying in this vicinity, and it will become popular. The Reserves gained worlds of publicity and the 464th Squadron will receive applicants. At least, the organization will become widely known by its efforts.

Air Service Appointments

Brereton, Maj. L. H., from Paris to Washington, D. C., temp. duty, then to Post Field, Ft. Sill.

Wash, Maj. C. W., as Asst. Mil. Attache Paris.

Crissy Field Flying Circus

The Flying Circus for the benefit of the Army Relief Fund was held at Crissy Field on Sunday, May 21st, and was enjoyed by approximately ten thousand visitors. Mather Field was present full strength, bringing some twelve ships to add to the already long line. The events were run off in the following order:—

Battle Formations from Mather Field. 15 DH-4B Battle Planes.

Exhibition of death defying acrobatics and wingwalking, introducing the famous "Breakaway" by Wesley May, "The Supreme Dare-Devil of the Air," on plane piloted by Captain Lowell Yerex, the distinguished English "Ace."

Stunt Flying: Captain Lowell H. Smith, "Fokker" and Lieuts. L. F. Post and John W. Benton, "S. E. 5"; and Sergeant Thomas J. Fowler, "Curtiss JN4-H."

Daring exhibition of Flying Upside-down by Pilot Clyde Pangborn.

Twenty-five Mile Crissy Field Trophy Race between Lieuts. Russell L. Maughan, Geo. A. McHenry, Wm. R. Seeley and Lt. M. S. Boggs, 316th Reserve Squadron.

Changing from Plane to Plane in Mid Air, Wesley May transferring from the upper wing tip of an aeroplane flown by Clyde E. Pangborn to the dangling rope ladder suspended from the aeroplane flown above by Captain Lowell Yerex.

Aerial Combat: Captain L. H. Smith in the "Fokker" and Lieut. John W. Benton in the "S. E. 5."

Exhibition of aerial gunnery, demonstrating a gunnery target towed by an aeroplane, machine guns and bomb dropping. Sergeant Paul D. Andert on the tow target; Lieut. Leo F. Post, Pilot, and Corporal Melvin C. Wignall, Observer, on the attacking aeroplane.

Five-thousand foot dash through space with a parachute, introducing the "Bullet-drop" by Wesley May from a plane piloted by Captain Lowell Yerex.

Grand Aerial Ensemble. Fifty planes of seven different types flying over Crissy Field at one time.

Personal Paragraph

Lieutenants Robert E. Selff and Wm. C. Goldsborough have completed their seven-thousand mile photographic mission, having photographed all available landing fields in Northern California and Nevada.

Mather Field Notes

The members of the 28th Squadron (Bomb.), participated with the City of Sacramento in the observation of Memorial Day on the 30th. Patriotic exercises were held in the cemeteries during the morning and a huge number of city, state and federal organizations paraded at 1.30 P.M., in the afternoon, Lieutenant S. C. Carter commanding the Mather Field contingent.

Civilian fliers at the Field during the week were Mr. L. Morris, with mechanic, en route from Crissy Field to Reno, Nevada; and Mr. Robert Tanner (a former member of his command) in a J.N.4-D, on his way from Gridley to San Francisco, with Mr. M. Delarno as observer.

On behalf of the farm owners adjacent to Mather Field a very active campaign against gophers and squirrels is being waged here under the direction of Mr. W. Jackson of Sacramento, in charge of rodent control for this part of the state. Regardless of all precautions taken by farmers to rid their property of Rodentia, the butt of the target range on the Field made a safe haven for the animals after they had raided the nearby wheatfields, and a corps of workers from Sacramento are getting rid of the pests very quickly.

Buffalo is still producing planes. A train load of Army Training Planes leaving the factory of G. Elias & Bro.

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FOREIGN NEWS

The Klémperer Wing Load Indicator

The instrument shown in the attached illustration is one developed by Herr Klemperer, the designer of the well-known Aachen gliders. It is a compact form of indicating accelerometer and gives directly in multiples of gravity the intensity of the foeces on a mass carried by an aeroplane—or other vehicle—due to acceleration.

It therefore serves to indicate the intensity of loading on the wings of an aeroplane produced by manœuvres, or atmospheric disturbances. The indications are in plain figures, 1 corresponding to steady flight and the normal loading due to the weight of the machine, 2 to twice that loading, and so on.

The scale rotates past a fixed pointer, and only a small portion of the scale is visible. Part of the scale—that corresponding to dangerous loads—is coloured red, and the appearance of red through the aperture gives the pilot warning that the particular manœuvre causing that appearance is one subjecting the machine to loads approaching a danger point. Obviously this red portion of the scale can be arranged at any suitable part of the scale to suit machines of varying degrees of strength.

There is nothing novel about this use of an accelerometer, but hitherto this type of instrument has been used only in a form suitable for research work. A clear indicating instrument of this type may be of some value for routine test and demonstration work.

The Coupe Deutsch

It is now announced that the second annual contest for the Coupe Deutsch will take place at Etampes on Sept. 22nd. As regards entries, it is a little early to make any definite statements, but there is certainly little activity in certain camps that are known to regard aeroplane racing favorably.

In France a Nieuport entry is regarded as certain, and it is said that the "Sesquiplane" is being altered accordingly. The plane surface is being reduced by roughly two square metres, and the power is being increased, but whether by "boosting" or a different power unit is not yet known.

A Hanriot entry is contemplated, but it is not known whether the D.H.22 which was designed for last year's contest, and so far has not flown, or a machine at present being designed, will be used.

It is rumored that M. Béchereau, well known as the designer of the Deperdussin monoplanes and the earlier Spads, has under construction at the Letord factory, a high-powered fighting Scout. Also, the Etablissements Bernard are constructing a high-speed all-metal machine, both presumably for the Aviation Militaire, but there is no reason why either or both should not form the basis for entries from both these firms.

It will be remembered that the Borel racer entered for the last Gordon-Bennett contest was merely their very efficient two-seater fighter fitted with racing wings and embodying some minor refinements as to streamlining, etc. This machine, although it did not compete, showed itself, in flight, to be as fast, if not faster, than the winning machine.

The United States have showed themselves to be highly interested in international speed contests, and a resolution signed by Rear-Admiral Moffatt and Major-Gen. Pattrick, the respective chiefs of the U. S. Navy and Army Air Services, was submitted recently to Congress urging official participation in all contests at home and abroad. Also the Aero Club of America have definitely fixed August 15th or thereabouts as the date for elimination trials to be held, if necessary, at Mitchell Field, L. I., should any entries materialize.

At least one entry from Italy is expected, and with the number of Italian competitions that are arranged for this year it is hoped other firms will think it worth while to construct special machines, the qualities of which may warrant their entry for what is generally considered to be the "Blue Riband" of the speed world.

French Aviators Cool to Santos-Dumont

The cool reception which marked the arrival in France of Alberto Santos-Dumont, pioneer builder of dirigible ballons, reached its climax when Rene Fonk, French aviation ace and a Deputy from the Vosges, failed to put in his appearance at the Tuileries, from which he had been advertised to fly in a French balloon with the South American. Fonk left for the Vosges without giving the Aero Club of France any intimation of his decision not to participate in the race.

Although the club officials profess to believe that Fonk was delayed in the Vosges on account of provincial elections, those who are close to him insist that his absence was due to antipathy to the man who at the beginning of the war after collaborating with French aviators manifested a Germanophile attitude and left France to remain in Brazil, his native country, in seclusion while his former colleagues risked their lives.

French Planes Carry Ten Thousand in Year

French commercial airplanes last year covered a distance of more than sixty times the girth of the earth, with only one accident for every 800 trips. In forty accidents, including forced landings with motor trouble, there were only eleven deaths and six persons injured—according to aviation officials, a record not yet achieved by any other country.

The French now have eight lines operating reaching London, Brussels, Rotterdam, Amsterdam, Strasbourg, Prague, Warsaw, Toulouse, Casablanca, Barcelona, Lausanne, Bordeaux, the Riviera and Corsica. The number of passengers carried totaled just over 10,000, with 175,000 tons of baggage and mail carried. There are now 236 machines available, with a combined horsepower of 80,000, and 100 pilots. Schedules are being maintained with 97 per cent efficiency.

London-Paris Express Planes Now More Luxurious Than Ever

The airways are steadily developing smoother and more luxurious travel as the railways did, but at a much faster rate. The latest thing in the Paris service is the new type of Handley-Page saloon express, two of which went off from Croydon recently after being christened by Gen. Brancker as his first performance as Director of Civil Aviation.

Instead of smashing the bottle of champagne against the fragile side of the aeroplane, Gen. Brancker knocked the neck off the bottle with a hammer and splashed the froth against a strip of paper which concealed the names "Princess Mary" and "Prince George."

The new machines carry twelve people—four more than is usual at present—and 500 pounds of baggage. They weigh five and a half tons when fully loaded and have an average cruising speed of ninety miles.

The passengers can move about inside and each one has his own window, which can be opened. The machines are fitted with the wireless telephone and travellers can telephone to London on the way by handing their messages to the pilot. The accommodation generally is that of a first-class railway carriage, with racks for light luggage. Six more of the same type are being built.

Fast passenger aeroplanes between Paris and Cherbourg will now run in conjunction with the ocean services. The Cunard Steamship Company has arranged, as from June 1, with the Messageries Aeriennes Francaise for an aeroplane service to connect with the arrival and departure of the express Cunarders calling at the French port.

By using the air service, passengers will save at least five hours in the journey to and from the French capital.

In the case of passengers arriving from New York, on landing at Cherbourg they will join a waiting motor car and proceed to the aerodrome from which place they will fly direct to Paris. Outward bound passengers can arrange for an aerodrome motor car to call for them at their hotel. Passengers can take a certain amount of baggage.

British Wireless Service

The British Air Ministry announces:—

On and after 15th June, 1922, the forecasts of the meteorological changes anticipated in S. E. England which are included in the aerial route weather reports issued by Wireless Telegraphy from the Air Ministry at 08.35 G. M. T., 11.35 G. M. T. and 14.35 G. M. T. will, for brevity, be issued in code and not in plain language as hitherto. Details of the code are to be found in "Forecast Code for the Abbreviation of Weather Forecasts transmitted by Telegraphy or Radiotelegraphy" (M. O. 244) which may be obtained from H. M. Stationery Office, price 1s. 0d. net.

Great Display at Hendon on June 24th

The Royal Air Force Pageant is again being held for the third year in succession, at the London Aerodrome, Hendon, by kind permission of the Graham White Company, on Saturday, June 24th.

The Pageant is an integral and important part of the annual training of the Royal Air Force and fulfils the same functions as does the Royal Tournament in the case of the Army and Navy, as it is impossible for the Royal Air Force to give any effective display of its work in an enclosed space.

The Pageant provides an opportunity, which it would be difficult to obtain in any other way, of bringing together representatives of the different types of squadrons which carry out the varied work of the Royal Air Force, such as aerial fighting, bombing, reconnaissance and the like, and giving them practice in association with one another. This enhances its value from the training point of view, while a valuable stimulus to keenness and efficiency is provided by the inter-unit competitions and displays.

The experience of the two pageants already held at Hendon has proved that the general public is keenly interested in Service aviation and welcomes the opportunity of obtaining a first hand knowledge of the work of the Royal Air Force.

A programme has been arranged which will fully equal that submitted in previous years. New features are being introduced which will enable the public to appreciate the developments that are constantly taking place in the aerial arm.

Full details of the programme, the most spectacular item of which is the destruction of the desert stronghold by bombing aircraft, will be issued shortly.

(Concluded from page 344)

Observer, Mr. Langham. Radiator used, 250 square feet.

Ground temperature, 32° C. Shutter open during climb? Yes.

Water in entire system, 135 pounds. Water lost during test, 3 quarts.

Altitude observed A	Strut temperature B	Water inlet temperature No. 8.229 C	Water outlet temperature No. 8.17 D	Temperature difference E	Revolutions per minute F	Indicated air speed G	Time (minutes) H
Ground	33	59	64	30	1,580	72	...
1,000	25	67	72	45	1,560	72	0.6
2,000	22	74	80	55	1,560	69	1.4
3,000	20	75	81	58	1,550	69	2.2
4,000	18	76	81	61	1,550	69	3.1
5,000	16	75	80	62	1,550	67	4.2
6,000	14	74	79	63	1,550	66	5.2
7,000	12	71	76	62	1,550	65	6.3
8,000	10	70	75	63	1,550	65	7.3
9,000	8	69	74	64	1,540	62	8.3
10,000	6	65	70	62	1,540	61	9.7

LEVEL FLIGHT

10,000	6	50	55	47.5	1,650	102	5
8,000	10.5	55	60	47	1,660	109	6

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ELEMENTARY AERONAUTICS *and* MODEL NOTES

Model Aeroplane Details

(Continued from last week)

Tracter Wing Incidence

Constructing incidence in tractor wings is not met with favor by some flyers but it has several advantages not so apparent at first. On thing is that both wing clips are alike, another, a change of incidence lends stability to a wing and finally it raises the center of pressure (without a surplus of dihedral) to where it belongs in a hollow spar model. It is claimed that not much efficiency is lost by the drop down.

Propeller Shafts

Propellor shafts are very similar to "s" hooks on the rubber end and are generally made of the same size wire. "A" is one with a safety hook attachment. The safety hook bere must be able to pass through the bearing. "B" is part of a plain shaft like the "s" hook "B" on one end. "B" shows how the wire is bent over and back and then pushed through the propeller. In case the propeller is Balsa, and even if it is not it is wise to secure the shaft in place with a little AMBROID cement at "D" and also at "E". At "E" the propeller can be further protected from wear by a thin piece of copper with a hole in it. Three or four washers should be used on each shaft.

Propeller Clutch

The clutch enables the model to make a better glide by allowing the propeller to spin freely after the rubber is unwound. "A" shows motor-base with propeller shaft "B" in place for flight. On "B" washer "C" is brazed or soldered securely in place. The propeller "E" is free to revolve on shaft "B" with two bearings—one on either side "D", until the "F" end of the hook is caught under hook "G" which is fast to propeller "E" by inserting it in the wood and glueing it in the wood with Ambroid. When the rubber is wound up in the proper direction the end of the shaft "B" which is bent over at right angles "F" should be tight against "G" hook on the propeller, thus driving it around when it is released. When the rubber is unwound the propeller should release itself and continue to revolve in the same direction as long as the model continues to glide—thus cutting down the resistance.

Tracter Wing-Clips

Wing clips for tractors are what bold the wing in place and take up the torque of the air-screw, as well as give the wing its incidence in the majority of cases. "A" is the plain style used on Mr. Pond's indoor and outdoor tractors with much success. They are mounted with Ambroid cement only (which accounts for the success). "B" is made of two pieces of flattened wire bound in place with thread. This was the style used by Mr. P. Breckenridge when he broke three tractor records in one day. "C" is a good common style and if a bit of room is left for adjustment up and down, it is a very handy clip. It takes the torque of the propeller well. "C" is for the rear of the wing and "D" is the same thing for the front of the wing. "E" is practically the same thing as "C" and "D" except that it is bent around the motor-base as shown. "E" was used on Mr. Pond's 170 sec. indoor tractor model.

Dope: for Rubber, Covering Surfaces, Etc.

The doping of the wings of a model causes considerable trouble for some constructors, and for others they do not. To this latter class belong those who do not dope their wings at all except the Hydro wings. Dope is only to lay down the "fuzz" of the paper and make it tight and smooth. Dope must be used with considerable good judgment or it will shrink the paper too much and spoil the wing. Acetone with 5 or 10% of banana oil makes a very good dope. Pure banana oil is a good Hydro dope but shrinks most wings out of shape. If shellac is added it will not shrink as much but weighs considerable more. A good way to waterproof the paper without warping the wing in the least is to paint a sheet with banana oil, dip it in water and let it dry before it is put on the wing frame. In this case no more dope is added. For pontoons, three or four coats of banana oil will keep the water out. The under side can also be varnished to good advantage. Test for leaks by dipping in water. The holes cna be plugged with Ambroid. Do not use LePages glue on Hydro machines as it is very likely to loosen up and the parts separate. It is not necessary to dope the wings of light land models. For sticking paper to wings either glue, banana oil, or a mixture of the two can be used with the preference to the second. Ambroid is a very handy glue to use on models as it dries fairly quickly and needs no binding. Anything to be fastened with *Ambroid* should be so arranged that it will not be disturbed until the glue has dried. It is dry when it is amber hrown.

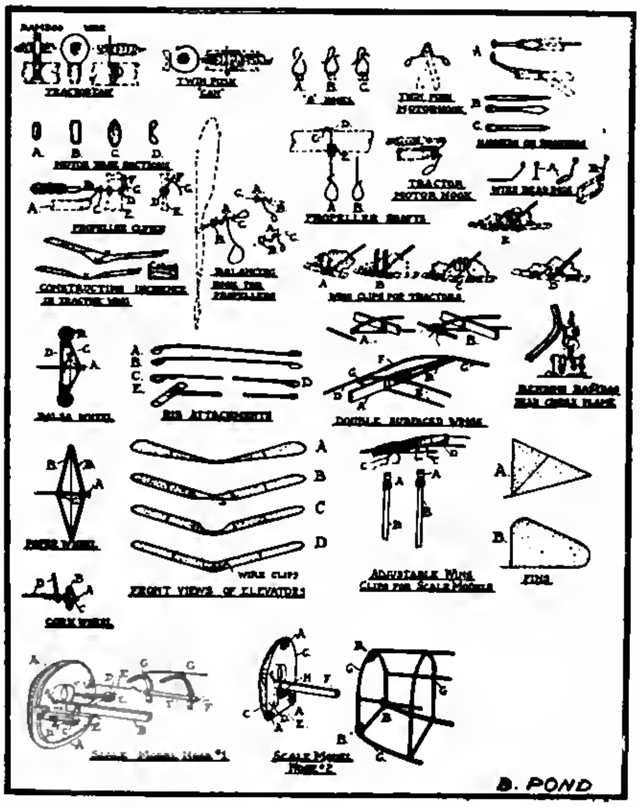
Rib Attachments

In rib attachment A, the front beam is below the rib and the rear beam is above the rib. In B, both beams are below the rib. One turn of thread is sufficient if glued with Le Page's, but Ambroid properly applied will hold without binding. In C, Mr. Hittle has struck terror into the heart of the poor bamboo benders by winding the rib around the wing-beam and tying a knot in itself. At D, the wing-beam is slipped into the split rib and glued into place. In E, the rib is inserted into the beam as shown in two views. If care is used in gluing a butt joint may be made with the use of Ambroid.

Front View of Elevators

Elevator A has a variable incidence along its whole length, and being inefficient is not found on record machines now, but some of the old record machines were equipped in this manner. B, is about the best compromise devised so far to eliminate blocks or supports. C, is a much harder way of doing the same thing as in B. D, is a very efficient elevator, the most efficient in fact, but it takes all the trouble of a wire clip in front to hold it up. Style B, was used on Mr. Pond's record machines and therefore must be of efficient design.

(To be concluded)



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RADIO DIGEST

Variometer Is Useful Part in Receiver

One of the most useful instruments in the radio receiving set is the variometer. It is most efficient on a short-wave set, and as the broadcasting stations are all operating, by government decree, upon 360 meters, the variometer finds a very large sphere of usefulness in the radiophone system. It affords a means of getting continuous variation of the inductance in the radio frequency circuits without the disadvantage of sliding contacts or the multipoint switches that are used in other forms of inductance. It also has the advantage that it can be readily and simply constructed.

Another important point in its favor, when used with the vacuum tube sets, is the fact that its peculiar nature permits the variation of its inductance without any break in the continuity of the circuit. This is very important in vacuum tube work, because with the multipoint switches used in other inductances, unless they are very carefully designed and constructed, the circuit is apt to be broken while the adjustments are being made, and in some cases this will tend to paralyze the vacuum tube.

Consists of Stator and Rotor

A variometer is constructed in two sections—one known as the stator and the other as a rotor. The stator, as its name implies, is a stationary winding in a suitable form, while the rotor is a winding upon a coil which rotates upon its axis inside of the stationary winding.

The operation of the variometer is as follows: If the rotor is turned in such manner that its plane coincides with the plane of the stationary coil, the current will circle through both windings in the same direction and their magnetic fields will add to each other. The self-induction of the variometer is then at its maximum point.

Should the rotor be turned completely around, the current will then flow through the two coils in opposite directions and the result will be that the two magnetic fields will oppose each other and the self-induction of the variometer will be at the minimum, or practically zero. Of course, if the rotor coil is at any other angle, we obtain varying degrees of self-induction, and it is by this means that tuning is affected with the variometer.

Variometers Standardized

In the past couple of years the variometers used in receiving circuits have become more or less standardized, and the forms upon which the two windings are laid can be obtained ready-made by the radio fan. They invariably come in three pieces—two of the pieces representing sections of the stator and the third piece being the rotor. The latter is invariably made in ball form.

For the novice who desires to construct his own variometer without obtaining any of these standard parts, the following instructions should be followed: Obtain two cardboard tubes—one six inches in diameter and the other five inches in diameter, both being two inches in length. Upon these wind single layers of No. 24 S. C. C. wire. The winding will not be continuously made, because in the middle of each tube a space of one-quarter inch must be left so that the shaft which revolves the rotor can be passed through both coils. The same amount of wire should be placed on each tube, completely filling the tube with the exception of the one-quarter-inch space in the middle and a slight space on each edge.

The outer tube can be mounted on a wooden frame after a hole has been drilled sufficiently large enough to take the piece of quarter-inch round brass rod eight inches in length. The inner tube should be fastened to this brass rod so that it will revolve with it. One end of the rod will have an adjusting knob attached to it. A scale can be added if desired. The turns should be thoroughly shellacked after the winding is complete, in order to prevent that from loosening up.

Standard Blocks Can Be Used

With the standard wooden blocks or composition blocks that are sold for variometer purposes all that will be necessary is to wind the spaces left for winding with No. 22 D. C. C. wire, so that the entire space is filled up. At the first glance it will look as though the task of wiring the stator section will be extremely difficult, but if these instructions are followed it will not be a very hard task.

Cover the sections of the stator with a coat of shellac and before this dries put your winding upon it, seeing that the winding is snug and tight. After this is completed cover with another coat of shellac and force the windings into position and then allow it to dry.

In assembling the variometer, the end of the stator winding will be carried on and connected to the beginning of the rotor winding. In this case, however, a flexible connection of sufficient length must be left between the two coils in order to permit the rotor to be turned completely around without breaking the connection. Another way is to use the brass shaft as a means of connecting the two coils together, so that the rotor coil can be spun completely around.

Majestic Radio Among Finest in the World

The arrival of the gigantic White Star liner *Majestic* in New York emphasizes the wonderful and rapid strides that have been made in the development of wireless telegraph apparatus within the past few years. This remarkable progress has recently been overshadowed by the spectacular expansion of the radiophone caused by the sudden public favor, but it has been none the less important.

Within a comparatively small space in the wireless cabin of the world's largest ship there is installed one of the most complete, compact and efficient wireless systems yet devised. The giant ship carries two types of transmitting equipment and two types of receivers. The transmitting apparatus consists of a 1½-kilowatt quench gap spark set and a continuous wave transmitter using one big vacuum tube with an output of 1½ kilowatts. The range of the quench gap set is approximately 400 miles, while that of the continuous wave set is in the neighborhood of 1,000 miles.

The receiving apparatus consists of a complete receiver with a wave length range covering everything now in daily use and a radio-goniometer, or direction finder. The latter is probably the most unique of the radio equipment aboard, and differs materially from the standard American practice in that it utilizes two loop aerials of extremely large dimensions, permanently rigged on the ship, in an unvarying condition.

Spark Used for General Calls

At the first glance it might seem superfluous to install a spark transmitter on a ship when its efficiency as compared with the continuous transmitter is so low. In this conection it must be remembered that continuous waves are extremely sharp in their tuning, while the spark is much broader. Under the circumstances, therefore, the spark is much better suited for the purposes of sending out general calls, and particularly so for sending out the distress call.

In addition to this the two types of transmitting apparatus naturally fall into two well-defined spheres of usefulness aboard. The continuous wave set operates on wave lengths ranging between 2,000 and 2,500 meters, and is well suited for communicating with the long-distance shore stations. The quench gap set is attuned to the standard short wave ranges set aside for ships by the International Radio Convention and is suited for ship-to-ship communication and the ordinary form of ship-to-shore work.

The continuous wave set operates on alternating current, which is rectified by two element rectifiers, of which there are two installed in the C. W. panel. The oscillating tube has an output of 1,500 watts. The transmitting equipment is completed by the addition of a 250-watt auxiliary quench gap set, designed for emergency purposes.

Direction Finder Is Unique

The regular receiving equipment, while very sensitive, does not depart from standard practice. It is in the radio-goniometer, however, that the chief interest in the apparatus aboard the *Majestic* lies. This consists of a special type of receiving transformer, and a six-valve amplifier. The latter has four stages of radio frequency amplification, one detector bulb and one stage of audio frequency amplification—or, as the English call it, a note magnifier.

The remarkable thing about this amplifier set is that all of the six bulbs are controlled by one rheostat and a potentiometer which controls the initial grid potential of all six tubes. The audio frequency section of the amplifier can be switched out of the circuit, if not required. This is arranged when taking bearings on stations that are comparatively close.

As has already been said, the loops used in conjunction with the direction finder are quite novel. They are based on the Bellini-Tosi system, and consist of a thwartship loop and a fore and aft loop, rigged up close to the wireless cabin, and supported in a manner that has now become standard on British ships.

Operator Aids Navigation

With this apparatus the wireless operator becomes an important factor in the navigation of the ship, especially in foggy weather. With his aid the position of the

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ship can be determined within a very few minutes by taking bearings upon well-known land stations, as all of the latter are listed in the international call books with their exact latitude and longitude. It is also possible to tell the exact bearing of other ships.

In foggy weather it is possible by means of the direction finder to determine roughly the distance of another ship, while its direction can be determined with exactitude. This is an important function, and one bringing a new factor of safety to navigation, as it will tend to reduce collisions at sea during fog.

In addition to this the direction finder has an important use in badly congested wireless areas, such as that in the vicinity of New York Harbor. In these cases, where interference is very bad as a result of so many stations attempting to work simultaneously, the operator can change over to his direction finding apparatus and use it for receiving purposes, thus cutting out all interference except that which emanates from the same direction as the station he desires to listen to.

Condenser Aerial Tested by Bureau of Standards

The Bureau of Standards has been conducting a series of experiments with condenser aerials which show very promising results for short-wave reception. This type of aerial is very useful for mobile work, and was used to some extent during the late war. It consists of two strips of wire netting, composed of copper mesh similar to that used for mosquito screens. One strip suspended parallel to the ground acts as the aerial, and the other strip laid just above the earth acts as a ground. These strips are from 6 to 15 feet long and from 18 to 36 inches wide, and act as two plates of a condenser.

In a report of the experiments so far conducted, J. C. Warner, the assistant physicist of the radio laboratory of the bureau, says:

"Experimental results show that a condenser antenna of small dimensions gives excellent results when used at wave-lengths below 400 meters. At longer wave-lengths it suffers by comparison with the coil antenna when the dimensions are kept small enough for portability.

"It is useless for directional work unless used with a coil antenna, but may be used in places where the sharp directional characteristics of the coil are objectionable. By proper design and by taking precautions to keep dielectric losses low the effective resistance may be reduced to a value lower than can be obtained either with the coil antenna or the ordinary elevated antenna.

"On account of this low resistance and ease of construction this form of antenna should be of great value in portable short-wave radio stations, such as are used for military purposes and on aeroplanes, although in the latter case some difficulty may be experienced in keeping down dielecric losses.

"It is evident that the study of this interesting form of antenna is by no means complete. Its use as a transmitting antenna offers a wide field for investigation, and a large amount of work remains to be done in following up the investigations, which have only been started in this study. For example, signal intensity measurements should be made with a calibrated detector set or with a radio-frequency comparison method, so that the actual current or E. M. F. in the antenna is measured. Further work should be done in determining the best design of antenna for a given wave-length and for minimum resistance. Also, this antenna furnishes a means of studying the form of the electro-magnetic wave, and a large amount of work might be spent profitably in this study, as well as in the checking of transmission formulas."

Radio Ameliorates Hard Tasks of Men On Isolated Duty

Improved service for shipping and better living conditions for members of the United States Lighthouse Service have resulted from the use of the radio, according to the Department of Commerce.

Formerly a tender would be dispatched from a lighthouse depot to repair or replace a buoy. After a round trip of perhaps several hundred miles it would often be necessary to repeat the journey to take care of another buoy in the same general locality. The radio is eliminating this waste of time, money and material as the vessels can now be kept informed as to when and where they are to be located. This enables them to complete the work in any particular locality before proceeding to another.

Last month the Department of Commerce authorized small additions to the radio equipment of several of its larger sea-going tenders to enable the crews to receive the radio broadcasting services for instruction and entertainment purposes, and consideration is now being given to making some similar use of the radio equipment placed on many of the lightships during the war, but not used since the Armistice, as well as on the principal outside lightships where a regular radio service is now maintained These latter, such as Nantucket and Diamond Shoals lightships, are the outpost radio stations on our coasts, reporting incoming ships, forwarding messages, and sending word of vessels in distress.

With the co-operation of the Navy, radio telephones have recently been installed at several of the remote lighthouses in Alaska.

Some of the lightships are also equipped as radio fog-signal stations, with the new Department of Commerce system, this being used during foggy weather to furnish accurate bearings to ships possessing the radio compass.

According to George R. Putnam, Commissioner of Lighthouses, radio should be a great boon in relieving the lonely and monotonous life of the faithful keepers at isolated stations both on lightships and at lighthouses. The keepers at the Alaska lighthouses at the entrance to Bering Sea remain at their posts for three years on a stretch; they have been without mail for ten months. At Tillamook Rock Light, off the Pacific Coast, bad weather has prevented direct communication with the shore for periods of seven weeks at a time. On the offshore lightships supplies are received only once a month, and the tenders often work in remote localities. Relaxation at these stations depends chiefly upon libraries furnished by the Government and donated magazines with an occasional phonograph presented through a thoughtful friend.

Developing Phones for Motor Cars

One of the latest radio developments is the radio car. A leading motor company has proved that radio equipment operates satisfactorily in an automobile without the use of a "ground."

The possibilities which this portable radio receiving station offers include an almost limitless field.

With a car equipped in the fashion depicted it is possible for a family to drive anywhere within 100 miles or so of a broadcasting station and picnic while the radio in their car amuses or instructs them. Education and entertainment can be made transportable. With a few cars equipped as this one, a clergyman could talk to a dozen congregations at once. Similarly, if the United States Department of Agriculture had similar radio equipment in the hands of its county agents, department experts could talk to thousands of farmers at once and thus bring the tremendous added benefits to agricultural districts that would otherwise be impossible.

Likewise the political candidate could send a radio equipped car to every voting area in his State and talk to all of his constituents at the same time, thus saving his vocal chords and making it possible for his hearers to stop listening when they were tired.

The installation of this equipment is so simple that it is possible to adapt it to many uses. It is only a matter of a few moments to remove the radio equipment from the car when it is not desired. It can then be used in the home or the office or any other desired place.

Just as anywhere on the high seas ships can keep constantly in touch with ports and other ships through the use of the radio, now the automobile—the land ship—can immensely facilitate distribution of information to the great benefit of mankind.

One ingenious amateur, by utilizing the power of the generator on his car, not only receives messages, but also transmits them.

Such equipment makes possible the use of motor cars as scouts or reporters of crops, weather or news messages from any part of the country.

The news reporter need no longer be obliged to beat his rivals to the wire. With a car equipped to talk instantly and directly with the radio office of his paper, he is free from all restrictions or competition.

Finds Manicure File Handy in Radio Kit

Dr. A. R. Curttis, of Rutherford, N. J., has added a manicure file to the necessary tools in his radio kit. To quote the doctor:

"In working around my crystal detector the other day listening in the sound was not clear, and somehow my fingers seemed too clumsy to get the detector at the identical point where it would be clearest. I happened to pick up a thin manicure file and slightly tapped the detector arm and just touched the galena with the whisker and got a most beautiful clear sound, and since then I have used this method, namely, tapping slightly with the file up or down with splendid results."

Vacuum Tube as Amplifier and Detector

The genesis of the vacuum tube, which is such an important factor in radio receiving apparatus, was described in an article in this section last week. In this story it is my intention to describe just how the wonderful instrument acts as a detector and amplifier. By doing so it might be well to point out one of the unusual possibilities of this instrument that is now engaging the attention of scientists.

Recently I was at a demonstration of one of these tubes producing alternating current of any desired frequency with a total outnut of 10 kilowatts of power. This means that in the very near future the vacuum tube will entirely discard the bulky and cumbersome machinery now used for the production of alternating current.

Feed-back System Discovered

In the last article I described the development of the vacuum tube from the

(*Concluded on page* 358)

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New Standard Three Passenger	*(with 160 H. P. Beardmore Motor)*	**$2500.00**
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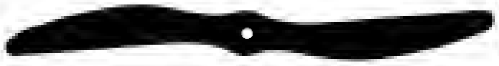

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(*Concluded from page* 355)

time that Edison first observed the effect of its practical application by Professor Fleming; and finally, the addition of the grid by Dr. Lee deForest. Up to this time we had a vacuum tube, but its possibilities were really unknown until Edwin H. Armstrong, a young American amateur, discovered the feed-back principles of transforming it from a simple vacuum tube into an electrical oscillator—a discovery which has given to it all of its remarkable possibilities and made it really and truly the modern Aladdin's lamp.

Now the manner in which the vacuum tube functions as a detector is as follows: As soon as the filament is lighted a train of electrons is thrown off from the filament and these bombard the plate. They are in reality particles of negatively charged matter, which actually bombard the plate with terrific impact. They afford a path for negative electricity to pass between the filament and the plate, and in order to assist the passage of this electricity the plate is charged with a positive potential. The grid enables us to control the action of the tube for this purpose.

When the incoming electro-magnetic waves pass over the aerial a very high frequency alternating current is induced in the oscillating circuit connected with the aerial, which passes this current on to the vacuum tube. The vacuum tube will only allow the negative half of this alternating current to pass through it. It completely checks the positive half and therefore acts as an electric valve in exactly the same way as the ordinary valve operates in a water-pipe system.

Pulsating Current Works Phone

We have, therefore, on the other side of the vacuum tube a current of electricity that is a pulsating current flowing in one direction only, and the telephone receiver is now able to respond to it. That is the manner in which the tube acts as a detector. As an amplifier, a slightly different condition exists and a different action takes place. In this case we have what is known as a "trigger effect," and the action of the tube in amplifying can be best described by using the trigger effect as an analogy.

If you study the mechanism of a rifle you will realize that when you cock the gun you have to use a great deal of force to pull the hammer back against the spring in the gun. When you pull the hammer back, what you actually do is to store up a certain amount of energy in the spring of the gun, which lies dormant until such time as you bring it into play by pulling the trigger. A little thought will show you how minute the pressure is that you exert on the trigger itself when firing the gun, but by releasing the trigger you bring into play the larger amount of energy that is stored up in the spring, and this forces the hammer against the cartridge in the gun with such force that the cartridge is exploded. This is exactly what the vacuum tube does—it controls the larger amount of energy that is stored up in the battery connected to the plate on the vacuum tube.. When the weak, incoming current reaches the grid or "control element" of the tube it releases this stored-up energy by pulling the grid trigger and permitting the plate current to come into play in the circuit. This action, of course, can be duplicated in successive stages of amplification.

Regeneration Described

It is this action that is also brought into play in the regenerative circuit. The tube, having acted as a detector, then passes its slightly increased current through the inductance in the plate circuit, and this inductance, being inductively coupled to the oscillating circuit, induces a still stronger current in that oscillating circuit, which again passes through the vacuum tube, releasing still greater energy in the plate circuit, and this action passes around again performing the same function, always simultaneously, until the certain maximum condition is reached.

This regenerative action can best be explained by using the analogy of the ordinary telephone. Sometimes, when the telephone rings and you lift off the hook and central still continues ringing, you occasionally get peeved and place the receiver to the mouthpiece of your telephone. The result is that gradually and rapidly you get a tremendous buzzing effect that finally reaches a loud and terrific whistle. What has taken place is simply this: The sound vibrations received in the telephone receiver have been fed back into the mouthpiece of the transmitter and the transmitter, of course, increases the sound and passes it around the circuit again to the receiver, which then again transfers it to the transmitter of the mouthpiece until the maximum, final strength is attained, which results in the terrible whistling, howling sounds that appear in the telephone.

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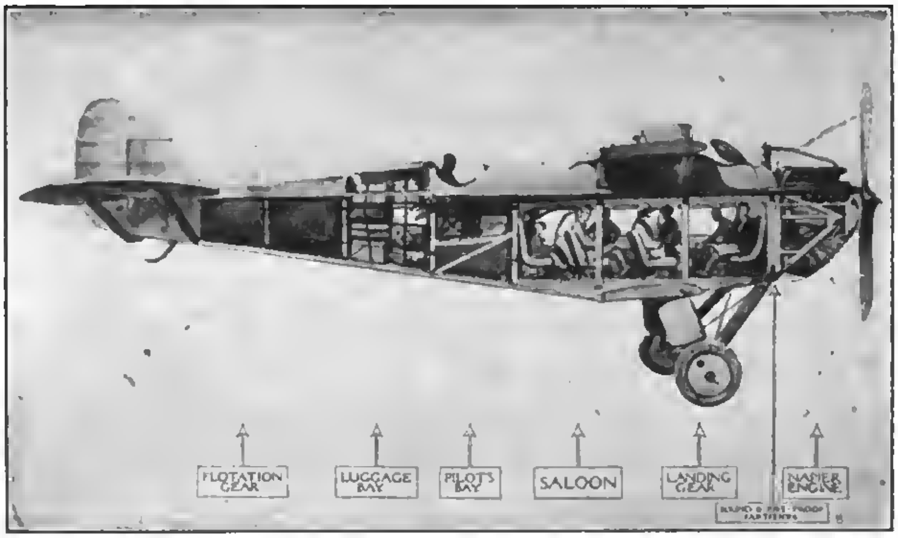
THE DH18



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GOODYEAR

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AERIAL AGE WEEKLY

VOL. 15, No. 15 16 | JUNE 26, 1922 | 10 CENTS A COPY

Including Radio Section

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Airscape of Los Angeles Country Club and Portion of the Golf Course. Photographed from Rogers Aircraft Field

Theory of the Slotted Wing—Stability of Aeroplanes—America Ready for Air Travel

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Buyers are reminded of the Sealed Bid Sale of Aviator's Clothing—Moleskin and Leather Coats, Leather and Canvas Breeches, Gauntlets, Goggles, Helmets, Electrically Equipped Flying Suits, etc., closing July 6th, 1922.

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Make a date now with yourself to be present at this sale on July 11, at the Curtiss-Elmwood Air Reserve Depot, 2050 Elmwood Ave., Buffalo, N. Y. The value to you of participation in this sale will be more apparent after you get a catalog by writing the Commanding Officer at the depot, or

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Room 2624, Munitions Bldg.

WASHINGTON, D. C.

WAR DEPARTMENT

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June 26, 1922

AERIAL AGE WEEKLY

Vol. XV, No. 16

TABLE OF CONTENTS

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
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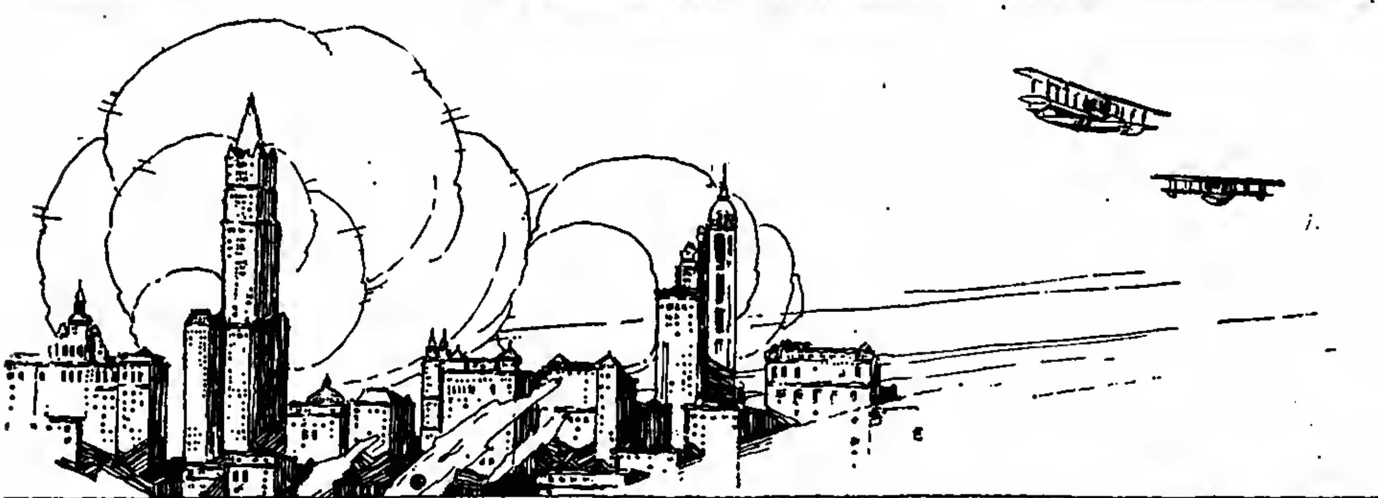

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IMPORTANT EDITORIAL ANNOUNCEMENT

WITH this issue AERIAL AGE will cease publication as a weekly magazine. It will henceforth appear as a monthly. The first issue in the new form will be dated August 1st, 1922, and will appear on July 18.

This change has been decided on after the most careful consideration of the present aeronautic situation and in an attempt to produce a magazine that will best develop and increase interest in aeronautics on the part of the American people.

The new AERIAL AGE will be greatly increased in size, will be printed on better quality paper, with cover in two colors. It will contain all of the regular departments and features of the present AERIAL AGE, and will have in addition specially written illustrated articles by world authorities, written from the point of view of increasing public interest in aeronautics.

It is contemplated that such a magazine will have a much wider appeal to the American people, and only by such a widespread appeal can we hope to be successful in properly presenting aeronautics to the American public.

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THE NEWS OF THE WEEK

Detroit Aerial Carnival

The first aerial carnival and flying meet for Detroit will be held under the auspices of the 310th Aero Squadron, 85th Division, U. S. A., on July 1, 2, 3 and 4. The preliminary announcement concerning the carnival follows:

In the past, Detroit has been sadly lacking in its aviation enthusiasm. One of the most important reasons for holding this meet is that, while Detroit and Wayne County have had assigned to them a Reserve Aerial Squadron, designated as the 310th Observation Squadron, 85th Division, U. S. A., Congress has failed to provide sufficient appropriations necessary to carry on the practical work such as the squadron requires to be accurate. Therefore, to secure the enthusiasm and support, civic and industrial interest of the community, it was felt that some tangible demonstration should be given to attain these ends.

The success of this event will not only enable the squadron to obtain the necessary funds to carry on operations at Selfridge Field, but will arouse interest among public and industrial organizations in this locality in preparation of the coming era of aerial transportation and the benefits of having Detroit on the Aerial Mail Route. The whole object is to promote aviation activity in every sense of the word.

The event will be supported in part by the Detroit Aero Squadron, a pure "dyed-in-the-wool" live organization, composed of between fifty and seventy-five flyers who have served in the American and Canadian Air Forces during the World War; in addition to a large number of observers, combat gunners, air service engineers, balloon men, mechanics and others familiar with the work and possibilities of aviation.

The First Air Carnival and Flying Meet is designed to interest the public from the commercial and industrial point of view, rather than from a sporting standpoint. It is particularly valuable from a viewpoint of National Defense and Preparedness, because our Government does not maintain a completely equipped and operating Air Service in times of peace.

Therefore, only through encouraging and upbuilding a Merchant Air Marine of trained personnel, by those qualified, can the country in general realize the great economic possibilities of Aerial Transportation. These two organizations are foremost in both lines of endeavor; one from the military standpoint, whose training was secured at enormous expense during the war, and others who have had a great deal of experience but are not connected with military organizations. All of this experience and enthusiasm will be given towards making Detroit the hub of aeronautic activities in the United States—which means the development of Commercial Aviation in Detroit and the opening of many possibilities from an industrial standpoint.

Larsen Responds to Rickenbacker

New York—Aroused by what he terms unfair criticism of American aviation, in statements attributed to Capt. E. V. Rickenbacker, whose plane was so badly damaged at Omaha, Neb., that he was forced to abandon his around-the-country flight, John M. Larsen, who improved the all-metal monoplane, issued a statement pointing out that there are many machines which could have made the trip successfully. Rickenbacker is quoted as saying, "no plane in the United States is fitted to make such a tour."

"Capt. Rickenbacker was my guest on a flight across the continent and back," said Mr. Larsen. "We made the trip easily. A pilot, a mechanician, and I flew from Omaha to Philadelphia two years ago without stopping, between daylight and dark. We carried much baggage also. The U. S. Air Service is flying many kinds of machines every day, and the Air Mail flies daily between New York and San Francisco with an efficiency performance of 95%."

Mr. Larsen, who is a Governor of the Aeronautical Chamber of Commerce of America, said that reports received by the Chamber indicate that more than 250,000 civilians flew in aircraft last year, more than 3,000,000 miles. He himself traveled from New York to the Arctic Circle and down into Mexico before returning to Manhattan in the same plane in which he started. He has traveled more than 300,000 miles by air.

"Most of my flying has been done in planes of similar type as that which Rickenbacker attempted to use," said Mr. Larsen. "The machine he used was an obsolete model, two years old, and one of three or four which had been withdrawn by the Post Office Department and sold, for a few hundred dollars, as salvage. They lacked the improvements I have made on the all-metal monoplanes since first introducing them into this country. Personally, I think Capt. Rickenbacker was misquoted or that he made the statement without realizing its full meaning."

The Giant Johan with aviator Horchem and his wife standing under his outstretched arms, in front of the Laird Swallow in which Horchem took Johan for a flight, under wager thnt with the giant in tho cockpit the Swallow would never get off the ground. However, at tho ond of five minutes they had climhed to an altitude of fifteen hundred feet, a most remarkahle feat for a ship tho siso of the Swallow, considering ths load. Johan is 24 ysars old, is 8 feet, 9½ inches tall, wsars a 22½ sixe collar and a numher 20 shoe, weighs 503 pounds

Spokane News

Spokane, Wash.—Interest in aviation in this city has been substantially stimulated as a result of the visit to the city of Rear Admiral W. F. Fullam, U. S. Navy, retired. The admiral is swinging around the circuit of army corps areas as the representative of the National Aeronautical Association. He has a breezy personality of exceeding charm and makes an exceptionally efficient envoy for the organization which planned the tour.

Arriving at Spokane early on the morning of June 5, Admiral Fullam was met at the depot by a delegation of representative citizens, including the mayor of Spokane and president of the Chamber of Commerce. Military Affairs Committee of the Chamber of Commerce is especially charged with the development of aviation in Spokane, and the committee was well represented in the reception committee. Thereafter Admiral Fullam's time was fully occupied. He spoke at the high school auditoriums, addressed the Chamber of Commerce, spoke to the garrison at Fort George Wright and was entertained at luncheons and dinners. The newspapers devoted a large amount of space to his visit with illustrations.

Determination to place the Spokane municipal aviation field at Parkwater in line with the best fields in the Northwest was expressed subsequently in a discussion of aviation by members of the city park board. Commissioner J. C. Argall, who formed part of the air board that attended Rear Admiral Fullam, reported that the admiral was favorably impressed with the Spokane field and promised development of aviation in a commercial way if Spokane got in line with other cities making a strong bid as aviation centers.

Adoption of rules to govern the air was delayed until after action is taken by the National Aeronautical Society at its convention in September, when nation-wide flying rules are to be adopted in conjunction with the army and the navy. Temporary rules will be adopted to govern flyers using the Parkwater municipal field this year. It was voted to make the fee for the season $5 a ship and to have the permit revocable by the park board at any time. All permits are to be issued subject to such rules as the board may adopt.

Personal Par

Arriving on the S.S. Pan America of the Munson Steamship Line from Rio de Janeiro on June 15th was Orton Hoover, Mrs. Hoover and their little daughter.

Mr. Hoover was formerly a Captain in the U. S. Army and is in charge of all aviation at the Brazilian Exposition. He reported having just sold forty-two Curtiss airplanes to the Brazilian Government.

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The AIRCRAFT TRADE REVIEW

Automobile and Aircraft Manufacturers Launch Export Campaign

New York.—A united campaign to sell American automotive transportation to the world was begun to-day on the departure from New York of Gordon Lee, Chief of the Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, who during the next two months will make a nation-wide tour, visiting a score or more cities.

Mr. Lee and Major Horace M. Hickam, representing the Army Air Service, who flew to New York from Washington, addressed a conference of automotive manufacturers at the Transportation Club. The conference was attended by representatives of the National Automobile Chamber of Commerce, Motor and Accessory Manufacturers' Association, Aeronautical Chamber of Commerce, Automotive Equipment Association, Motorcycle and Allied Trades Association, National Association of Engine and Boat Manufacturers, Association of Automotive Equipment Manufacturers, The Class Journal Company, and The Black & Decker Mfg. Co.

The campaign embraces the development of the foreign market for American constructed automobiles, motor trucks, aircraft, motorcycles, and motor boats. Mr. Lee expects to fly between many cities on his trip.

Progress of Aviation Matters in Congress

The following memoranda concerning progress of aviation matters in Congress has been prepared by the Aeronautical Chamber of Commerce:

April 12—*House*

Mr. Sisson discusses the Navy Bill (H. R. 11228). He believes the battleship is dead and has been supplemented by the aeroplane. He believes that the nation that controls the air controls the sea and the nation that controls the sea controls the world.

May 2—*House*

Mr. Oldfield: A bill (H. R. 11515) providing for the purchase of certain inventions, designs, and methods of aircraft, aircraft parts, and aviation technique of Edwin Fairfax Naulty of New York; to the Committee on Appropriations.

May 8—*House*

Conference report of the Post Office Bill (H. R. 9859) submitted. In amendment No. 40, $1,900,000 is provided for air mail service.

May 9—*House*

Brief filed with the Department of Justice by the Contract Audit Section of the Air Service in the Lincoln Motor Case printed in the record.

May 13—*House*

Post Office Bill (H. R. 0859). Appropriation of $1,000,000 for air mail passed House.

May 15—*House*

Discussion of aircraft contracts in the consideration of H. R. 11645 a bill providing appropriations for the prosecution of the war contracts.

May 17—*Senate*

The Vice-President laid before the Senate a communication from the Secretary of War, transmitting in response to S. Res. 266 information relative to a school of aeronautics; which was referred to the Committee of Military Affairs.

House

Mr. Hicks in H. R. 11214, a bill authorizing the President to scrap certain vessels in conformity with the provisions of the Five-Power Naval Treaty, urges the converting of two battle cruisers into aircraft carriers.

May 20—*House*

Mr. Jefferies of Nebraska: a bill (H. R. 11723) to authorize and provide for payment of amounts expended in construction of hangars and maintenance of flying fields for use in the Air Mail Service of the Post Office Department; to the Committee on Post Office and Post Roads.

May 27—*House*

Mr. Hicks unanimous consent to lay on the table H. R. 5219, a bill to create a Bureau of Aeronautics in the Department of the Navy, and the Bill H. R. 6297 authorizing the construction of an aeroplane carrier for the Navy of the United States.

May 31—*Senate*

Vice-President laid before the Senate a communication from the Acting Secretary of the Navy, transmitting in further response to Senate Resolution 266, agreed to April 5, 1922, information relative to the establishment of an academy of aeronautics at the Naval Academy and the manufacturer of aircraft at naval stations, etc., which was referred to the Committee on Naval Affairs and ordered to be printed.

June 2—*Senate*

War Department appropriations (H. R. 10871). Aircraft appropriations amendments agreed to. Amendment allowing $400,000 for Helium experimentation reduced to $300,000 and agreed to.

Aircraft Appropriations

	Allowed in Budget	*House*	*Senate*
Navy Bill—H. R. 11228	$17,043,310	$7,866,950	
Army Bill—H. R. 10871	15,210,770	12,431,000	*$13,000,000
Air Mail—H. R. 9859	2,200,000	1,900,000	1,900,000
Nat'l. Adv. Comm. Aero.—H. R. 9981	250,000	210,000	210,000

* Still under discussion. The helium appropriation has been cut from $400,000 to $300,000.

No appropriation bill has been signed as yet by the President. The Army and Navy bills are being held up in the Senate on account of the tariff bill. The other bills are either in conference committees or the conference reports of these committees are waiting approval of Congress before going to the President.

The Navy Bill was reported by the Senate Committee June 10th, 1922. This Report raised the appropriations for aircraft to $14,703,950.

To Study Plans of JR-1

Washington.—A special committee of leading engineers and structural experts appointed by the National Advisory Committee for Aeronautics met in this city May 18 to make a complete and thorough study of the Navy's giant airship ZR-1, as requested by Rear Admiral William A. Moffett, Chief of Naval Aviation.

The committee is composed of Henry Goldmark, a consulting civil engineer of New York, who was responsible for the design of the great steel lock gates of the Panama Canal; William Hovgaard, professor of naval architecture at the Massachusetts Institute of Technology, Boston; W. Watters Pagon, a consulting civil engineer of Baltimore, and an expert on bridge and structural steel work; Dr. L. B. Tuckerman, engineer-physicist of the Bureau of Standards, who was connected with the tests of the full-sized structural parts of the ZR-1; and Dr. Max Munk, technical assistant of the National Advisory Committee for Aeronautics and an expert on aerodynamics.

At a recent meeting of the National Advisory Committee for Aeronautics, Admiral Moffett, a member of the Advisory Committee, requested that a detailed technical study of the plans for the Navy's first fleet airship, parts of which are now being fabricated, be made by a special committee to check the plans as prepared by naval designers. Accordingly, the Special Committee on Design of Airship ZR-1 was organized by Dr. Joseph S. Ames, chairman of the Executive Committee, and instructed to make a thorough investigation and prepare a report. The object of the report is to pass upon the design and calculations, including the method of determining the load factor and factors of safety used in the design submitted by the Naval Bureau of Aeronautics.

It is estimated that the special committee will require ten to twelve weeks to complete its work and submit report to the National Advisory Committee for Aeronautics.

Seventh Corps Association

The Commercial Aeronautical Association of the Seventh Corps Area has had its Constitution and By-Laws printed in a neat booklet, which will be supplied to anyone interested on applying to Ralph W. Cram, Davenport, Iowa, president, or John B. Coleman, Sioux City, Ia., secretary. The association is organized to promote the interests of aviation, the location of landing fields and to do everything possible for the development of commercial aviation in the eight states comprising the Seventh Corps area. It expects in September to become a district of the proposed National Aeronautical Association to be organized at Detroit.

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THEORY OF THE SLOTTED WING*

Lecture by A. BETZ, Göttingen

THROUGH the intensive study of all technical aviation problems during the war, the most important aeroplane parts, especially the wing, were so thoroughly tested as to create the impression that no further substantial improvement was possible. The characteristics of the different wing sections were sufficiently known to enable one to select the most suitable section for almost any purpose.

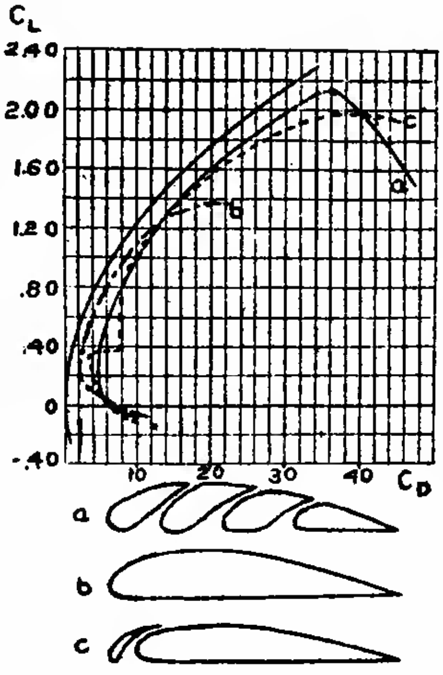
Then the discovery by Lachmann and Handley Page suddenly revealed entirely new possibilities and the wing section again became a rich field of problems. As probably you all know, this discovery consisted in making one or more slots in the wing section (Fig. 1). In this way it is possible to use the wing at higher angles of attack and thus considerably increase the lift. The lift-drag ratio, however, seems to be no better in general than for ordinary wing sections. The advantage lies principally in the ability to vary the coefficient of lift, and hence the speed, within considerably wider limits. Hereby the difficulties of taking off and landing are diminished and greater flight speeds made possible. Our knowledge of the behavior of such slotted wings under the most diverse conditions is, unfortunately, very limited, and there is still much work to do before we shall have carried our investigations so far as to be able to choose, from the many possible modifications, the one best adapted for any given purpose.

The question of the most practical importance is what must be done in order that with an aeroplane we can obtain the best possible lift-drag ratio if the lift-coefficient is low and, in addition, be able to reach by easily made changes, a considerably higher coefficient of lift, where the lift-drag ratio does not need to be especially good. The former condition would be used in ordinary horizontal flight and the latter in taking off or in landing. The purely experimental solution of all the problems connected with these new wing sections is rendered very difficult by the large number of possible modifications. The most diverse cross-sections may be given the component parts of the wing and their relative size may be varied, thus bringing the slot nearer either the leading or trailing edge. Furthermore, the relative position of the parts and the width of the intervening slot may be varied. Lastly, there is the possibility of varying the number of the component wing-parts by the introduction of one or more slots. Although, for structural reasons, many forms do not come into practical consideration, the number of possibilities is still very large.

The experimental work will be considerably simplified and rendered more productive of results, if we succeed in obtaining at least an approximate idea of what takes place. We are still, however, far from being able to give a complete theoretical explanation of the phenomena of slotted wings. Nevertheless, we can contribute something toward the explanation of the unusual increase of the lift coefficient. I do not wish, however, to create the impression that what I am about to say is conclusive. I wish rather to bring the matter up for discussion, in the hope that still other viewpoints may be presented, which will help to clarify the problem.

We must first consider the question as to how it happens that, with a given wing section, the lift coefficient cannot be increased at will. In order to answer this fundamental question, we must consider more carefully the process by which lift is generated. It is known that lift is produced by the greater velocity, and consequently smaller pressure, of the air on the upper side of the wing, than on the lower (Fig. 2.). This difference must vanish at the trailing edge, around which the pressures can become equalized. The difficulty lies in the fact that a strong suction must be generated on the upper side, only to vanish again at the trailing edge. From the point of least pressure on, the kinetic energy of the air must therefore be transformed into pressure by a gradual increase in the cross-section of the tubes of flow. There accordingly takes place, on the rear portion of the upper side, a phenomenon very similar to the flow through a widening tube.

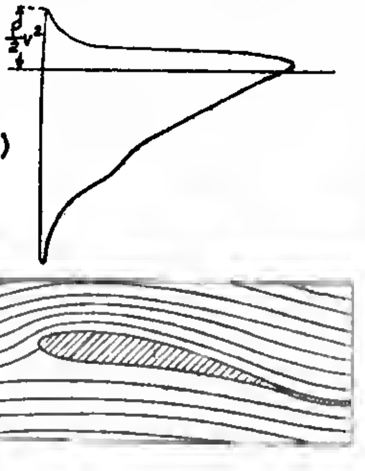
Now, it is known that such a flow, in which kinetic energy is transformed into pressure, remains stable only for a very gradual increase in the size of the cross-section. If the diameter increases too rapidly, the air does not continue to flow smoothly along the wall, but separates from it and goes its own way as a free jet, and the increased pressure is not obtained. If we increase the angle of attack of an aeroplane, the cross-sections of the tubes of flow on the suction-side are increased; and if a certain figure is exceeded, the air no longer flows along the upper surface of the wing, but is torn off, as it is expressed. This phenomenon is shown by Figs. 3 and 4. (The photographs were made by Dr. Heis and published in Prof. Prandtl's report on the Göttingen Aerodynamic Laboratory, in the Year Book of the Air Traffic Association, 1912-1913.) The first picture shows a wing having a normal angle of attack. The flow conforms quite



well to the top of the wing and is not seriously affected by the small vortices which cover the wing. With larger wings and greater velocities, the vortices are probably still smaller. The second picture shows the same wing at a somewhat greater angle of attack, in which case the fluid no longer follows the top of the wing.

Involuntarily we now ask how it happens that the air does not separate on even a moderate increase in the diameter of the cross-section. The explanation lies in the viscosity of the air or, in most cases, more correctly, in an apparent viscosity, which, in turbulent phenomena, is conditioned by the turbulence itself. The cause may be pictured qualitatively as follows: The

(b)



(a)

fluid has a tendency, on account of its inertia, to flow straight ahead, instead of following the curved surface, but then there must exist, between it and the surface of the wing, a quiet or an eddying "dead-water" region. This "dead water" is now carried along by friction (or the effect of viscosity) and must be constantly replaced (Fig. 4). Now, when the viscosity is so great that, in a given time, more fluid is carried away than can flow in, the "dead water" disappears and the flow follows the surface of the wing (Fig. 3).

Such are the general outlines of the phenomena which produce lift and which also limit its magnitude. Unfortunately these phenomena cannot be treated quantitatively by theoretical methods. We must therefore content ourselves with qualitative illustrations and will now endeavor to explain, on this basis, the action of the slotted wing.

For the sake of simplicity, we will assume that there is only one slot. Such a wing section may be imagined as a biplane with a very great positive stagger and a very small distance between the wings. Some justification for this conception proceeds from the fact that, even with an ordinary biplane, the maximum lift is increased by a positive stagger. According to biplane measurements published by myself in the fourth volume of "Zeitschrift für Flugtechnik und Motorluftschiffahrt." the maximum C_L without stagger was 100. with a positive stagger of 30° it was 110 and for one wing alone it was 106. Similar results were also obtained in England (Technical Report of the Advisory Committee for Aeronautics, 1915-16, Rep. 196. Sect. 11). Though the differences are not

* Reprint from "Berichte und Abhandlungen der WissenschaftlichenGesellschaft für Luftfahrt" (Supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt"), No. 6, January, 1922.

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great, they would evidently be greater, if the stagger were increased and the interval between the wings diminished.

We will first consider only the front wing and discuss how its characteristics are affected by the rear wing. From the theory of the biplane, we know that the flow is here obliquely upward. This affects the lift-drag ratio, but not the maximum coefficient of lift, which here alone interests us. We also know that, at this point, the flow forms a curve with the concave side up. This has about the same effect as increasing the wing camber. By increasing the latter, the maximum lift may actually be increased, though only to a very limited degree and at the expense of the lift-drag ratio. The rear wing is similarly affected by the curvature effect. It may therefore be assumed that the influence of the curvature of the flow plays a role of some importance with a given wing section with a moderately large camber, but nothing further is thereby gained than would be gained by a larger camber. The extraordinarily large increase in the maximum lift cannot therefore be thus explained.

The following consideration may be of more importance. The front wing lies in a region of increased velocity. Now, since the force of air is proportional to the square of the velocity, it is evident that the lift on the front wing is thereby considerably increased. This argument has but one exception, namely, that the reverse is true of the rear wing, so that for the combination of the two wings the two effects neutralize each other. In calculating the relations for an unstaggered biplane, we even obtain a smaller maximum lift than for the two wings alone and this result is confirmed by experiments. The relations are, however, somewhat changed by staggering. We must go into this more thoroughly.

We will first consider the arrangement with two wings of about the same size in which the relations stand out the clearest. The front wing, taken alone, would have a pressure distribution somewhat as shown by the fine line on the left of Fig. 5. Now, if we bring the rear wing, which has about the same pressure distribution by itself, into proximity with the front wing, the trailing edge of the latter will lie in a region of great velocity, and correspondingly small pressure, produced by the rear wing. The leading edge of the front wing, on account of its greater distance from the rear wing, lies in air that is much less disturbed and consequently in a region of nearly normal pressure. The leading edge of the front wing is, accordingly, not much affected by the pressure on the rear wing, while the pressure on the trailing edge of the front wing is diminished. We will therefore obtain, for the front wing, a lift distribution corresponding somewhat to the dash curve in Fig. 5.

Through this modification of the pressure curve, the pressure increase on the suction (upper) side becomes much flatter. On the other hand we know that the limit of the lift is determined by the steepness of the pressure curve. It is therefore evident that we may now further increase the angle of attack, until the inclination of the pressure curve again reaches its limit value (heavy line in Fig. 5). Since the velocity has become greater everywhere, the pressure curve may climb steeper than before.

As is obvious, the lift, which is represented by the area inclosed by this curve, has become considerably greater.

Let us now turn our attention to the rear wing. Here we find corresponding phenomena. The front wing produces on the leading edge of the rear wing a decrease in velocity and a consequent decrease in the

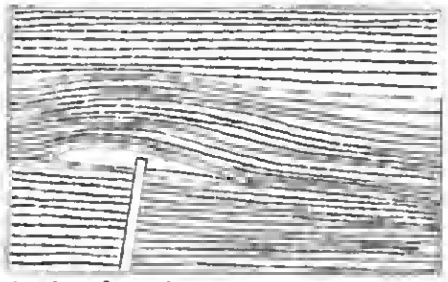


Fig. 3. Flow about a wing section at an angle of attack of 8°.

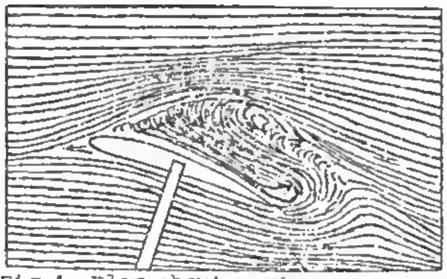
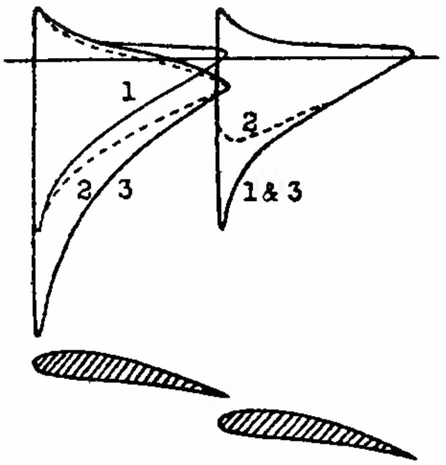


Fig. 4. Flow about a wing section at an angle of attack of 19°

pressure diminution or suction. The trailing edge remains practically unaffected. Thus we obtain here, near the leading edge and mainly on top, an increase in pressure. The strong suction (or negative pressure) is diminished, so that here also there is a flatter pressure increase, as shown by the dash line. By increasing the angle of attack, we return approximately to the original curve, while the lift of the rear wing remains practically unchanged. Hence, in this combination the two wings produce a greater maximum lift than when separate, the gain being principally on the front wing.

The phenomena described will perhaps be more intelligible if we take for comparison the perfectly analogous phenomena of a simple and a compound Venturi tube. Fig. 6 shows a double Venturi tube, such as is often used on aeroplanes for measuring air speed. If we first imagine the small inside tube removed, we have a simple Venturi tube. The air flows through the constricted section with increased velocity and correspondingly diminished pressure. In the diverging cone behind it, the kinetic energy is again largely transformed into pressure, so that at the rear end, the external and internal pressures are again equal. Exactly the same causes which limit the lift in a wing, here make it impossible to obtain, by narrowing the throat, a pressure diminution of any desired value. In this case, however, it has long been known how to increase the suction by a suitable combination of tubes. Such an instrument is shown in the figure. The exit of the inner tube is at the point where a diminished pressure is already produced by the outer tube. The latter now forms the starting point for the further pressure diminution in the inner tube, just as in the case of the front part of the slotted wing section, which we have already considered.



We assumed in our discussion that the two parts of the wing were of about the same size. In practice, however, the front part is usually much narrower than the rear part. Our assumption that the pressures on the leading edge of the front part were not noticeably affected by the rear part, no longer holds true. Here the whole of the front section lies in a field of increased velocity and is thus able to produce a greater lift, since the lift is proportional to the square of the velocity. For the rear section, however, our previous remarks hold good. The disturbance due to the front section is felt principally on the leading edge, which therefore has approximately its normal lift. Accordingly, we even here obtain increased lift for the whole combination.

That the actual pressure distribution is approximately as described, follows from the data published by Handley-Page in "Engineering," March 4, 1921. These data are given in Fig. 7. For small angles ot attack, the rear section shows about normal lift distribution. The auxiliary wing in front gives only a small lift, since its angle of attack is much too small. Only from 12° up does the lift of the auxiliary wing show any considerable increase, while the pressure distribution of the main wing remains almost the same. The increased suction on the trailing edge of the auxiliary wing is also evident. At about 20°, the flow separates from the main wing and the lift of the auxiliary wing diminishes.

The above conception of the phenomena renders the occurrence of an increased lift coefficient somewhat more comprehensible and even offers the prospect of making it possible to compute the relations. On the other hand, the following consideration may be presented. If the slot is continuously narrowed, the arguments pointing to a higher maximum lift continue to hold good, but the phenomena vanish when the slot is closed altogether. This was to be expected from the first, since the wing is transformed by closing the slot into one of a practically normal shape. In any event, a slot of a certain minimum width is essential. Since the theory just presented, says nothing about this, the phenomena must also be considered from a different standpoint.

In explaining the phenomena of lift production, I called attention to the fact that the clinging of the air stream to, or its separation from, the upper surface of the wing depends on whether the dead air is carried off fast enough. When we consider this phenomenon on the rear section of a slotted wing, it is obvious that the work (which may be called pump-work or suction) must be performed at the expense of the kinetic energy of the thin air stream flowing through the slot. If the latter is made too narrow, the ribbon of air finally becomes so thin that its kinetic energy no longer holds out to the trailing edge of the rear section, but is, itself, transformed into dead air by mixing with the dead air above and below it. When considered from this standpoint, the phenomena of the slotted wing appear in quite another light. We can now think of this wing section as an entity, derived from an ordinary wing section by connecting its upper and lower surfaces by slots, which is, in fact, the con-

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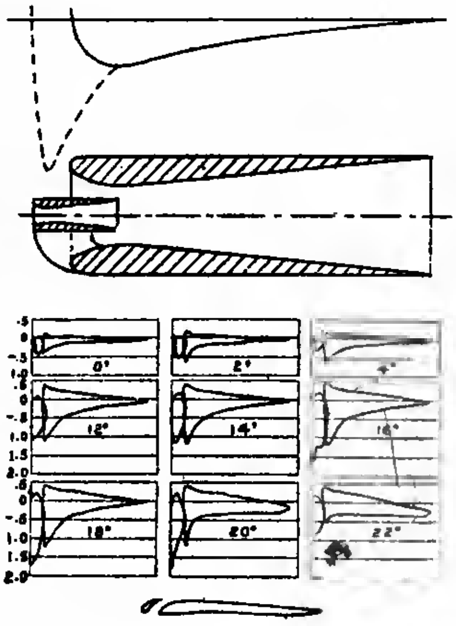
ventional conception. The slots convey new energy to the marginal layer of air retarded by friction on top of the wing, thereby increasing its velocity and thus preventing the accumulation of dead air. The air stream flowing out of the slot acts like the jet from a syringe and reinforces the air stream on top of the wing in carrying away the dead air. Since the production of lift depends on the efficiency of this pump-work and the maximum lift is conditioned by the limited possibility of carrying off the dead air, it is apparent that any increase in the pumping efficiency increases the maximum lift.

We are now inclined to ask which of these two theories is the right one. The answer is that both are equally correct, since they both explain the same phenomena, but from different standpoints. We should rather ask which viewpoint is the more practical. To this question I would reply that we have use for both, according to what we wish to learn. The conception of the slotted wing as a biplane whose wings mutually influence each other has the advantage of enabling computation to a certain extent. With its help, we may succeed in constructing formulas which will



enable the determination, in some measure, of the quantitative relations. The second viewpoint is essential, when it is desired to form an idea of the requisite width of the slot. I would add a word of warning against too great optimism. The relations are much more complicated here, than, for example, in the theory of the monoplane or biplane. Much work must still be done, before these theories are developed into practical rules. With the limited means now available, much time will be required for this work. The immediate task is to determine whether the theories just presented really explain the essential features of the phenomena, or whether other circumstances of decisive influence will come in. This cannot be conclusively determined from the experimental data now available. If the theory, however, agrees with the facts, this is already a great gain, even though we do not succeed in working out convenient computation formulas. We then know, at least, what the essentials are for obtaining the right shapes and can thus save ourselves much useless work.

(Translated by the National Advisory Committee for Aeronautics.)

ELIAS & BRO. PUT NEW COMMERCIAL PLANE ON MARKET

G. ELIAS & BRO., INC., of Buffalo, New York, on May 17 were awarded a War Department contract for two experimental machines of their design for a Type 12 Bomber, which was pronounced by the Department as the best plans submitted for the type specified. The Elias Company have received several awards for designs, notably these: June 1st, 1920—$3,000 prize for contract for three machines of their design for Air Service training planes; November 30th, 1920—$4,500 prize for the best three-seater multi-motor machine; June 28th, 1921—second prize for a ship-board plane, $10,000 by the Navy Department; August 2nd, 1921—$3,000 award for two-seater night observation plane.

Aside from these activities, G. Elias & Bro. have produced for the commercial market the Elias-Stupar aeroplane E-S-1 (biplane). It has 5 seats, including that of the pilot. It is designed to meet all requirements for commercial work; and the cost of operation is estimated to be 3.2 cents per pound load every 100 miles, 8 cents a passenger mile, with baggage; or 5 cents a passenger mile without baggage. Its cruising range with full load is 400 miles. There are 46 cubic feet of cargo space, with 14 cubic feet additional if necessary.

The following are approximate figures of cost of carrying cargo per 100 miles, based on an assumed distance of 300 miles between terminals:

Fuel and Oil	$ 9.00
Pilot	2.50
Upkeep (mechanics, spare parts, etc.)	11.00
Overhead (rental of field, telephone, office assistants, etc.) Based on a route where 5 machines are in use.	8.00
Depreciation and Insurance	2.50
Cost of transporting 1,000 pounds 100 miles	32.00
Cost per pound per 100 miles	3.2c

Other specifications are:

Spread	34 ft. 5¾ in.
Length	24 ft. 4 in.
Height (tail on ground)	9 ft. 4 in.
Height (fuselage level)	9 ft. 8 in.
Total Wing Area (including ailerons)	385 sq. ft.
Aileron Area	51 sq. ft.
Horizontal Stabilizer	20 sq. ft.
Vertical Stabilizer	7 sq. ft.
Elevators	25 sq. ft.
Rudder	14 sq. ft.
Gap	5 ft. 6 in.
Chord	5 ft. 6 in.
Gap Chord Ratio	1 to 1
Dihedral between motors	0°
Dihedral overhang	2°
Angle of incidence relative to center line of propeller shaft	3°
Angle of incidence with tail skid on the ground	17°
Power	2-80 h.p. LeRhone
Motors	160 h.p.
Fuel capacity	86 gals.
Oil capacity	12 gals.
Seating capacity	5
Baggage space—in addition to passenger compartments	10 cu. ft.
Total cargo space when no passengers are carried	46 cu. ft.
Weight, empty	1569.52 lbs.

Non-pay useful load, consisting of:		
Students control	4.50	
Cushions, except pilot's	36.69	
Safety Belts, except pilot's	6.00	
Fire Extinguishers	20.00	
Gasoline (3 hr. supply)	360.00	
Oil (3 hr. supply)	72.00	
Pilot	162.00	
Total	675.88	
Pay load	955.60	
Total useful load		1631.48
Total weight of machine fully loaded		3200.00
Light load (definition) Minimum weight of machine for one-half hour flight, consisting of:		
Weight of machine empty	1568.52	
Pilot	160.00	
Fuel for one-half hour	60.00	
Oil for one-half hour	12.00	
Total		1800.52

Wing loading, light load (1800 lbs.)	4.80 lbs. a sq. ft.
Wing loading, full load (3200 lbs.)	8.55 lbs. a sq. ft.
High speed, light load	90 m.p.h.
High speed, full load	90 m.p.h.
Landing speed, light load	35 m.p.h.
Landing speed, full load	50 m.p.h.
Climb, full load	400 ft. per min.
Climb, light load	1000 ft. per min.

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STABILITY OF AEROPLANES

By EDWARD P. WARNER

Professor of Aeronautics, Massachusetts Institute of Technology*

THERE is a very general misunderstanding about the amount of skill and natural aptitude required for flying an aeroplane. One often lnds an impression among persons not directly associated with aeronautics or in a position to be kept informed of advances in that science that the operation of an aeroplane is somewhat analogous to walking a tight rope, and that the piloting of such machines is possible only for those who have the natural aptitudes of the trick bicycle rider or the aerial acrobat. As a matter of fact, of course, flying is extremely easy. In many ways it is easier than driving an automobile, and any sound person can learn to fly at least fairly well, if not to be a pilot of exceptional skill.

The popular misconception regarding the difficulty of flying arises largely from the belief that the aeroplane is an essentially unstable vehicle and that it is continually watching for a chance to get out of equilibrium and hurl its unwary pilot to his doom. While such strictures might have been justified, at least to a slight extent, in connection with some of the early aircraft, there is no reason for them now, as the modern commercial or touring aeroplane is extremely stable and steady in flight. It not only does not deliberately depart from its normal course but even resists any attempt to make it do so. In fact, some aeroplanes are so stable that pilots object to them on the ground that it is impossible to make them fly in an abnormal position when that is necessary for the purposes of a particular maneuver.

Automatic Pilots

Such stabilization does not require the use of any elaborate mechanical device. In the early days of flying all sorts of schemes, most of them involving pendulums and gyroscopes, were proposed and tried and some succeeded very well in stabilizing the aeroplane or at least in exercising the functions of the pilot, relieving him of the duty of operating the controls. It should be emphasized, however, that the mechanism merely operates the controls, and that no such thing as a true stabilizer, operating directly on the aeroplane as a gyroscopic stabilizer acts on a ship, has yet been produced. A real stabilizer, at least if it were of the gyroscopic type, would be far too heavy to be carried in flight. Some of the devices for keeping an aeroplane on an even keel are already described by their inventors as automatic pilots or mechanical pilots, rather than as stabilizers, and it would be well if the same terminology were to spread to all the other cases.

No automatic pilot has gained any real wide measure of favor. The difficulty of piloting is not great enough to require the intervention of any new devices, especially since they do not relieve the pilot of his most difficult task, that of making a landing. Pilots have a natural distrust of any new mechanism and hesitate to permit the introduction of an instrument, the multitudinous gears and levers hidden away from inspection, on whose continued perfect functioning the pilot's life must hang. They far prefer to depend either on their own skill and watchfulness or on the natural stability of the aeroplane secured by the form and disposition of its rigid parts.

Stable Designs

A skillful pilot can fly an unstable aeroplane successfully. Quite aside from this fact, however, there really is no need for elaborate mechanisms such as are frequently produced, as it is not difficult to make any desired degree of stability inherent in the aircraft, arising from the very design of the machine. In fact, the point has been reached where it is possible to lay down a few simple rules which suffice to insure stability, at least in longitudinal motions. To prevent pitching an to insure that it will not attain a dangerous magnitude is far easier than to prevent the aeroplane becoming unstable in roll. Although the most uncomfortable oscillations of an aircraft are those in pitch, the aeroplane being unlike a ship in this respect, there is little danger from such oscillations if the slightest attention was given to stability in the design.

Stability in roll, however, and the securing of directional stability, or the tendency to maintain a straight course and to resist any tendency to go into a turn, are much more difficult to secure and the problems connected with them are not yet fully understood. The most frequent cause of accident is still the spin, a particular form of lateral instability. Aeroplanes have been built which were "spin-proof," which would never assume a spinning attitude of their own accord, but the means by which that much to be desired characteristic was obtained are not yet clear enough to make possible their certain duplication on another design.

Reliance in Mathematics

The study of stability and its improvements on given types of aeroplanes is one of the most important in connection with which further study is required. Development in this direction can come only through the enthusiastic cooperation of the aeroplane designer, the experimenter in the laboratory or in free flight, and the mathematician to whom the theory of the subject is due. It cannot be too strongly emphasized to those who do not already know it that the whole procedure in designing stable aircraft is based on a mathematical theory originally produced by pure mathematicians and physicists, some of whom had never had the slightest experience in flight. That it is now possible to produce an aeroplane which can be flown for long periods without touching the control is due largely to the genius and patient labor of Professor Bryan and Dr. Leonard Bairstow and others in England and of Prof. E. B. Wilson and Commander Hunsaker and their co-laborers in other countries.

Mathematical analysis alone, of course, does not suffice, and the practical application of mathematics must rest on data obtainable in part in the wind tunnel or laboratory, in part only in flight. The most effective check on any deductions regarding stability is obtained hy making a succession of changes in an aeroplane and actually observing the effect which they produce on stability. Such work has been and is being done by the Royal Aircraft Establishment in England and by the National Advisory Committee for Aeronautics here, and on it no less than on the labors of the mathematician the production of safe and stable machines in the future must rest.

The final problem is to secure the devoted cooperation of the aeroplane designer. It is a lamentable fact that there yawns too often a wide gulf between the "theorist" and the "practical man," a gulf across which each party regards the other with scorn. The problems are too great to permit of any dissension as to who shall work on them, and the best results will be obtained only when the designer makes full use of the work of the experimenter and the mathematician and when those individuals of more theoretical bent carry on their labors with the actual practical needs of the designer constantly in mind.

* Taken from *The Christian Science Monitor.*

AMERICA READY FOR AIR TRAVEL

AT the ninth bi-monthly luncheon of the Aeronautic Executives, held at the Cafe Boulevard, New York, May 8, Major B. L. Smith, General Manager of the Aeromarine Airways, Inc., proved conclusively that there was adequate and efficient aircraft equipment at present in operation in this country to operate extensive air routes throughout the U. S. if public interest was sufficiently aroused.

In introducing Major Smith, Chairman R. R. Blythe stated that the Major was a pioneer naval aviator who had been flying since 1911. It was through his efforts, to a very great extent, that a branch of Naval Aviation was organized in America. During the war Major Smith won high recommendations from the Allied Air Forces for his efficient organization and operation of naval aircraft.

In the operation of the Aeromarine Airways between Key West and Havana and the Nassau-Bimini-Miami route there was a total number of 747 flights made over a period of six months, during which time there was carried 2,700 passengers and 10,800 pounds of freight.

"Of course, I am very enthusiastic about the results of our Southern operations, and aided us in making this very favorable owing to the fact that the tourist season record, we expect next year to even exceed the number of passengers and freight carried by a large percentage.

"The fact being that the public now realizes that there is a very much improved service between Key West and Havana which eliminates the eight-hour steamship trip across the 97 miles of open, and very often rough, ocean. This trip is made by air in one hour and fifteen minutes.

"During the 2,100 flying hours in the South," said Major Smith, "we have proved conclusively that commercial aviation is safe and that a commercial aircraft com-

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pany can be operated at a profit. One of our F5L's, the 'Ponce de Leon,' during two months made over 100 miles daily, and every third day completed a round trip from Key West to Havana, a distance of 200 miles. There were no accidents, but one wing tip pontoon was lost, the cost of replacement being about $148.00.

"We have operated through all kinds of weather and have a record of only three interrupted flights during our total season of operations.

"For a commercial seaplane there is not today a safer, more durable or commodious plane than the F5L. It is strong enough and sufficiently seaworthy to ride on the buffeting ocean waves which would swamp and sink a smaller plane.

"During the operations of these boats we have had the Santa Maria in the water as long as nine months. Even after the trying 7,000-mile flight last summer from Key West to New York over the Great Lakes to Chicago, down the Mississippi to New Orleans and back to Key West through many varying temperatures, the highest being 103 degrees in the shade, we had only to recover the wings and make some small paint retouching to the hull and tail section. The maintenance cost is extremely low on this type of plane. Of course, much of this is due to the care in operation and handling.

"Docking after flights presents most causes for injury to the craft, due to missing the mooring and drifting into the wharf or bumping the wings and hull. Even this feature is not serious, because the total costs for damage caused in docking would not amount in six months to sufficient to increase our regular pay-roll or supply orders.

"On July 1 we begin operations of a round trip daily between New York and Atlantic City with a 14-passenger flying boat, making this trip in 1 hr. and 15 minutes. This plane leaves 79th Street and Hudson River at 4:00 p. m.

"We will also inaugurate on the same date our Cleveland-Detroit daily service, making the trip in 90 minutes which takes 7 hours by rail."

Major Smith referred to the lack of public patronage of aerial transportation by the brief statement that the publication of the crash of the London-Paris aircraft featured in the Sunday papers decreased the gross income for passenger flights on the same day exactly 100% over the previous daily income.

"I am sure that if we only were given the publicity in the newspapers which has been devoted in the past to feature crashes and had in their place stories of sane aircraft operation, we would today be in a position to give daily air service anywhere in the United States for those who wish to cut traveling time in half, and that by this patronage the rates charged, which now seem extremely high, would be in turn only slightly in excess of that charged by railroads."

Among the aeronautic companies were represented the Aeromarine Airways, Inc., Gallaudet Aircraft Corporation, Netherlands Aircraft Mfg. Co., Wright Aeronautical Company, Curtiss Aeroplane & Motor Corp., J. L. Aircraft Corp., Loening Aeronautical Engineering Corp., American Airways, Inc., and Johnson & Higgins, Aeronautical Insurance Brokers.

SYLPHON DIAPHRAGMS

A Method for Predicting Their Performance for Purposes of Instrument Design

By H. N. EATON and G. H. KEULEGAN

Bureau of Standards

Introduction

THIS technical note was prepared for the National Advisory Committee for Aeronautics as a part of the report on the "Investigation of Diaphragms for Aeronautic Instruments," and the purpose of this paper is to show that the characteristic performance of a sylphon diaphragm can be predicted from a knowledge of its stiffness and of its dimensions. The proof is based on a mathematical analysis of this type of diaphragm, together with enough experimental data to prove the validity of the assumptions and the sufficiency of the analysis. Equations are developed for the performance of sylphons under various conditions of loading, both for concentrated loads and for hydrostatic pressure.

The results of the investigation will be useful in the design of instruments or devices containing sylphons, since, by measuring certain dimensions of the diaphragm and the deflection produced by a known concentrated load (to determine the stiffness), the designer will be able to predict the action of the sylphon under the above-mentioned types of loading within the limits defined below.

The load-deflection curve of a sylphon is linear over a considerable range, and over this range the errors due to imperfect elasticity (i.e., drift, hysteresis, and after-effect)* have been found to be less than 1 per cent of the maximum deflection and so can be neglected, as far as the object of this paper is concerned. The discussion which follows is limited, therefore, to the range of loading for which the load-deflection curve of the sylphon is a straight line and does not include a consideration of the effect of drift, hysteresis and after-effect.

Assumptions

The following assumptions will be made:

(a) The load-deflection curve of the sylphon for concentrated loads is linear. (This curve will be called the *characteristic curve* of the sylphon—see Fig. 2.)

(b) The errors due to imperfect elasticity (drift, hysteresis and after-effect) can be neglected.

(c) The external space between two successive corrugations is equal in volume to the internal space between two successive corrugations for deflections within the linear range.

(d) The cross-sectional area of the sylphon remains constant.

It has already been stated that assumptions (a) and (b) are warranted from experimental evidence. The range over which they hold good will be discussed later for a particular sylphon.

Assumption (c) is justified by the excellent agreement between results obtained experimentally and those obtained analytically by making use of this assumption. Assumption (d) is sufficiently accurate for the present purpose.

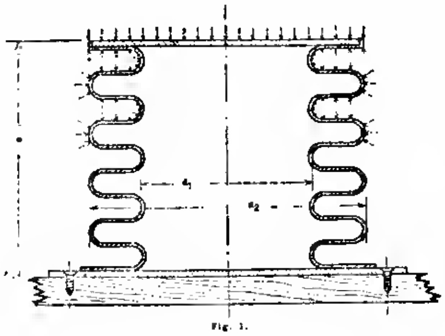

Fig. 1.

Notation

The following notation will be used:

L = concentrated central load.

P = difference of pressure between inside and outside of sylphon.

d_1 = internal diameter of sylphon. (See Fig. 1.)

d_2 = external diameter of sylphon. (See Fig. 1.)

y = deflection of upper face under load, measured from neutral position of upper face (i. e., under no load).

A = maximum cross-section perpendicular to axis $\left(\text{i. e., } A = \frac{\pi d_2^2}{4}\right)$

A_e = equivalent area.

l = length of sylphon.

h = depth of one corrugation.

V = volume of the sylphon.

v = average volume of sylphon per unit length $= \frac{V}{l}$.

W = work done on or by the sylphon.

n = number of corrugations.

S_s = spring stiffness $= \frac{L}{y}$

S_c = stiffness of sylphon for concentrated loads $= \frac{L}{y}$

S_d = stiffness of sylphon for distributed loads $= \frac{P}{y}$

S = stiffness of combined sylphon and spring when hydrostatic pressure is supplied to the sylphon.

g = width of gap between spring and sylphon before being coupled together.

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* These terms will be defined as follows:

Drift is the change of displacement under constant load.

Hysteresis is the excess of displacement with loads decreasing, over the displacement at the same load, with loads increasing.

After-effect is the residual displacement at any time after removal of the load.

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THEORETICAL DISCUSSION

Laws of Deflection

Consider a sylphon diaphragm with its axis vertical, its lower surface fixed, and with its upper surface consisting of a rigid plate (see Fig. 1). When concentrated loads are considered, it will be assumed that they are applied vertically at the center of the rigid plate. The discussion which follows applies only to the range of deflections for which the load-deflection curve is linear.

From assumption (a) and the definition of stiffness there follows:

(1) $L = S_c y$.

It will now be proved that a relation

(2) $P = S_d y$

similar to that expressed by equation (1) exists for loads produced by hydrostatic pressure.

Consider the system consisting of a sylphon with an applied concentrated load L. The interior of the sylphon is open to the outside air. While the sylphon is yielding to the influence of this load, the effective force, i. e., the force tending to deflect the sylphon, is $(L - S_c y)$. Hence during the infinitesimal distance dy the work of deformation is $(L - S_c y)\, dy$. The total work of deformation or the increase in potential energy of the system when the deflection has reached a value y_1 is

$$(3)\quad W = \int_{y=0}^{y=y_1} (L - S_c y)\, dy = L y_1 - \frac{1}{2} S_c y_1^2 = \frac{1}{2} S_c y_1^2$$

Now suppose a hydrostatic pressure P applied to the sylphon tending to nullify the deflection produced by L. Then if y is the deflection of the sylphon measured from its original position under no load, we can express P as a continuous and single-valued function of $y_1 - y$ as follows. Denote $y_1 - y$ by D.

(4) $P = A_1 D + A_2 D^2 + \ldots\ldots\ldots A_n D^n$

where $A_1, A_2, \ldots\ldots\ldots A_n$ are constants.

Suppose that P is taken sufficiently great exactly to nullify the deflection produced by L. During the cycle just completed, no unconservative forces have been introduced if we neglect the hysteresis and internal friction in accordance with assumption (b) and ignore the small effect due to viscosity of the air. Consequently, when the deflection has been reduced to zero by the application of the pressure P, the work thus done can be equated to $\frac{1}{2} S_c y_1^2$, the potential energy which was added to the system when it deflected under the influence of the load L.

Therefore,

$$(5)\quad W = \int_{D=0}^{D=y_1} KPdD = \int_{P=0}^{P=P_1} PdV = \frac{1}{2} S_c y_1^2$$

Substituting from (4) the value of P,

$$W = \int_{D=0}^{D=y_1} K[A_1 D + A_2 D^2 + \ldots A_n D^n]\, dD = \frac{1}{2} S_c y_1^2$$

or

$$(6)\quad W = \frac{KA_1 y_1^2}{2} + \frac{KA_2 y_1^3}{3} + \ldots$$

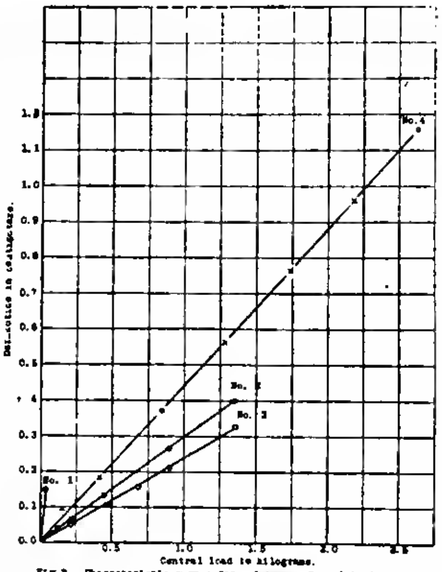

Fig. 2. Characteristic curves for sylphons. Nos. 1 to 4.

$$\frac{KA_{n-1}\, y_1^n}{n} = \frac{1}{2} S_c y_1^2$$

This equation must hold for any value of y_1; hence the coefficients of y_1^n must vanish identically; i. e.:

$$(6a)\quad \begin{cases} KA_1 = S_c \\ \text{and } A_2 = A_3 = \ldots\ldots A^n = O \end{cases}$$

Equation (4) now becomes

$$(4a)\quad \begin{cases} P = A_1 D \\ P = A_1 (y_1 - y) \end{cases}$$

Since we are considering only the linear portion of the deflection curve of the sylphon, it makes no difference where the initial position is taken; consequently (4a) may be written

(4b) $P = A_1 y$

where y is now measured from the position of the upper surface of the slyphon before the pressure P was applied. If we replace the constant A_1 by S_d, (4b) becomes identical with (2) and thus proves the validity of the letter. Experiment also verifies equation (2) (see Fig. 3).

EQUIVALENT AREA

Dividing equation (1) by equation (2) there results

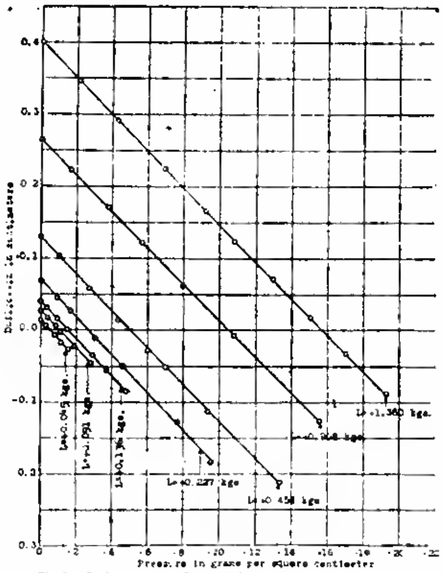

Fig. 3. Deflection of sylphon No. 2 with variable pressure under constant central load

$$\begin{cases} \frac{L}{P} = \frac{S_c}{S_d} \\ L = P\frac{S_c}{S_d} \text{ (y constant)} \end{cases}$$

Now the ratio S_c/S_d has the same dimensions as has area. It is also clear that this ratio for a given sylphon is dependent only on the geometrical and physical characteristics of the sylphon. Consequently it may be considered as a certain proportion of the maximum cross-sectional area A of the sylphon and will be called the *equivalent area* of the sylphon. The physical significance of the equivalent area may be seen most clearly perhaps by considering that a given hydrostatic pressure P produces the same deflection of the sylphon as does a certain concentrated central load L, and that the equivalent area is defined as the ratio of this L to the given P. Its usefulness consists in the facts that it is a constant for a given sylphon and that it enables one to predict the performance of the sylphon under any specified conditions, once the deflection for one concentrated load is known. The value of the ratio S_c/S_d or A_q will now be derived in terms of known constants and dimensions of the sylphon.

Returning to equation (5) we have

$$(5)\quad \int_{P=0}^{P=P_1} PdV = \frac{1}{2} S_c y_1^2$$

$$dV = d\,(lv) = vdl^* = vdy$$

and

$$P = S_d y \text{ from (2)}$$

$$\therefore \int_{y=0}^{y=y_1} S_d v y\, dy = \frac{1}{2} S_c y_1^2$$

or

$$\frac{1}{2} S_d v y_1^2 = \frac{1}{2} S_c y_1^2$$

whence

$$(8)\quad \frac{S_c}{S_d} = A_q = v$$

Now v may be computed from the assumption that the sylphon is made up of successive cylinders each of height h and alternately of diameter d_1 and d_2.

If there are 2n corrugations then

$$v = \frac{V}{l} = \frac{\pi nh\,(d_1^2 + d_2^2)}{2nh} = \frac{\pi}{8}(d_1^2 + d_2^2)$$

or

$$(9)\quad A_q = \frac{\pi}{8}(d_1^2 + d_2^2)$$

Experimental verification of this result will be given later.

For purposes of comparison it will often be convenient to express the equivalent area as a percentage of the maximum area. Thus,

$$(10)\quad \frac{A_q}{A} = \frac{(d_1^2 + d_2^2)}{2d_2^2}$$

$$(10a)\text{ or } 100\frac{A_q}{A} = 100\frac{(d_1^2 + d_2^2)}{2d_2^2} \text{ per cent}$$

*See assumption (c).

PERFORMANCE OF SYLPHON

From equations (1), (2,) (7), and (8).

(11) $L + A_q P = S_c (y_1 \pm y_2)$

where y^1 is the deflection produced by L and y_2 is the deflection produced by P.

Equation (11) contains two constants, A_q and S_c, which depend only upon the characteristics of the sylphon. A_q can be computed from purely geometrical considerations, but S_c must be determined by

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experiment. From a single deflection with a concentrated load it is possible to obtain S_c, provided care is taken that the range of loading for which the load-deflection curve is linear is not exceeded. It is also possible to determine A_q from a second experiment with distributed load, but it is usually preferable to compute the value of this constant from equation (9).

Performance

Suppose that a sylphon is distended by a spring either internal or external (see Fig. 4). The performance of the spring may be expressed by

(12) $L = S_s y$

Assume that, with the spring and sylphon mounted but not coupled together, there exists a gap g between the couplings. If the two are now coupled together, g is reduced to zero and the top of the sylphon is deflected an amount y_1. y_1 can be computed from the known values of g, S_c, and S_s and, consequently, the reaction of the spring and the sylphon upon each other L_a can be computed, as will be shown.

$$L_a = S_c y_1 = S_s (g - y_1)$$

$$(13)\left\{\begin{aligned} y_1 &= \frac{S_s g}{S_c + S_s} \\ g - y_1 &= \frac{S_c g}{S_c + S_s} \end{aligned}\right.$$

and

$$(14)\quad L_a = S_c y_1 = \frac{S_c S_s}{S_c + S_s} = g$$

Now let a pressure P be applied externally (or suction internally). Equating the force exerted by the spring to the elastic resistance of the sylphon and the load, there results

$$L_a + S_s y = L_a - S_c y + A_q P$$

where y is measured from the neutral position of the couplings when the sylphon and spring are coupled together.

Then (15) $A_q P = (S_c + S_s)\, y$

or

$$(15a)\quad P = \left(S_c + \frac{S_s}{A_q}\right) y$$

The quantity in parentheses is the stiffness of the combination of spring and sylphon and (15a) may be written

(15b) $P = Sy$

Four sylphons were tested in order that experimental confirmation of the preceding analysis might be obtained. The construction characteristics of these sylphons are given in the following table:

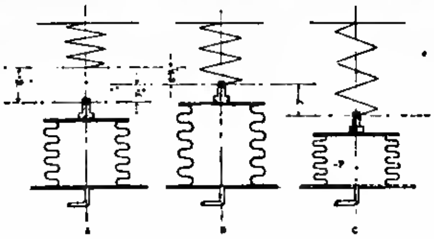

Fig. 4. Sylphon and spring in combination.

TABLE 1.

	No. 1	No. 2	No. 3	No. 4
Internal Dia.....cm.	4.1	9.5	4.1	9.5
External Dia....cm.	6.0	11.9	6.13	11.6
Thick. of Mat..cm.	0.011	0.025	0.025	0.025
Number of Corrugation	11	10	12	21
Material (Brass)				

Fig. 2 shows the characteristic curves for these sylphons. The value of S_c can be obtained from these curves, since from

$$(1)\quad S_c = \frac{L}{y}$$

Fig. 3 shows performance curves for Sylphon No. 2 determined experimentally. Extension and loads tending to produce extension of the sylphon are considered positive. The curves are linear over the range shown in Fig. 3. It was found that, when a load producing a deflection of —0.35 cm. was applied, the curve was no longer linear. The points in which the lines L = const. cut the axis of deflections is obtained from the characteristic curve of the sylphon. The points in which these lines cut the axis of pressure may be computed from equation (11) by putting $y_1 - y_2 = 0$, when

$$P = \frac{L}{A_q}$$

or, if preferred, the lines may be drawn through the proper points on the axis of deflection with the required slope. This slope is easily proven to be $+S_c$ from equation (11). The slope appears to be negative in Fig. 3, but it should be remembered that the pressures shown here are negative.

Fig. 3 shows that Sylphon No. 2 will give linear load-deflection curves from a deflection of about —0.2 cm. to at least +0.4 cm. The positive limit of linear deflections may be much higher than +0.4 cm., but the tests were not carried to the limit.

From a consideration of the way in which the family of curves in Fig. 3 was constructed, it is clear that each intersection of a line L = const. with the axis of pressures can be used to determine the value of A_q. Considering such a point we have the relation

$$A_q = \frac{L_1}{P_1}$$

This will be utilized to provide a check on the values of A_q as determined analytically.

TABLE 2.

Equivalent Areas of Sylphon.

P gms/cm²	L gms.	A cm²	A_q cm² Experimental	$\frac{A_q\%}{A}$ Computed	$\frac{A_q\%}{A}$ Exper'l
SYLPHON No. 1.					
4.32	91.0	28.3	21.1		
2.14	45.0		21.0		
1.07	23.0		21.5		
0.42	9.0		21.4		
Av.			21.25	73.4	75.2

The difference between experimental and computed values is 2.4%.

P	L	A	A_q		
SYLPHON No. 2.					
15.75	1361.0	111.3	86.4		
10.40	908.0		87.3		
5.00	453.0		90.6		
2.65	227.0		85.7		
1.55	136.0		87.8		
1.00	91.0		91.0		
0.45	45.0		100.0		
Av.			89.83	81.7	80.7

The difference is 1.3%.

P	L	A	A_q		
SYLPHON No. 3.					
64.5	1361.0	29.55	21.1		
44.0	908.0		20.6		
21.5	453.0		21.0		
10.7	227.0		21.2		
Av.			21.00	72.4	71.2

The difference is 1.7%.

P	L	A	A_q		
SYLPHON No. 4.					
26.0	2270.0	105.7	87.3		
20.8	1814.0		87.2		
15.3	1361.0		89.0		
10.2	907.0		88.8		
5.0	453.0		90.6		
Av.			88.58	83.4	83.8

The difference is 0.5%.

The agreement between the experimental and calculated values of A_q indicates that the equivalent area for any sylphon is independent of the elastic properties of the sylphon and may be computed from the expression

$$A_q = \frac{\pi}{8}\left(d_1^2 + d_2^2\right)$$

METAL CONSTRUCTION

By Rodolfo Verduzio*

Director of the "Instituto Sperimêntale Verduzio"

THE future development of aerial navigation is closely connected with the condition of obtaining aeroplanes of great stability and sufficient strength. Formerly, the science and technical knowledge of construction were deficient and the difficult problem of the necessary lightness for being supported by an element so thin as air was solved at the expense of the strength of the entire structure. This beginning, which has led to great and undoubted progress, has resulted in many accidents, and thus every advance has been accompanied by a series of mishaps. The evolution of aircraft has been quite rapid, but not so rapid as human evolution. The technician obtained a slight structural improvement, which the pilot recognized, appropriated and utilized to its fullest extent, and then sought something better. At the same time, he became more skillful and bolder, and tested the aeroplane more severely, so that it often gave out because it lacked just what the hand that guided it required. Thus it became necessary to make aerodynamic modifications and structural reinforcements. Abstaining for the present from taking up the problem of aerodynamic progress, we will consider the problem of structural strength.

The coefficient of safety, that number which represents in all structures the ratio between the breaking strength of a part and the load or stress which it must normally withstand, was quite a small number for the first aircraft. The poor constructor struggled with his own ignorance and his lack of adequate means. His aeroplane had neither suitable finish of form nor materials of suitable strength and lightness nor reliable engines, powerful and light. Hence they were heavy, clumsy, slow, and not very strong. But with such ill-adapted means, laws were determined, flights were made, and the course to be followed was outlined. Progress was made

* Lecture delivered before the "Associazione italiana di aeronautica."

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which, by gradually eliminating the defects due to ignorance, has reached its present state. This state is not the final condition, but simply a step to be used as the basis for still greater progress. Today the former modest coefficient of safety has been considerably raised, and is at least 10 for a swift aeroplane, and 6 or 7 for some parts of a good airship. These numbers, which have not yet been reached in most other kinds of construction, are not, however, the maximum limits for aeronautic construction. Pilots still demand much in the way of technical improvements.

The idea here promulgated seems contrary to the general opinion. How much more solid a house or a locomotive seems than a light aeroplane' How much more solid an automobile or a ship seems than a fragile airship! Nevertheless, the house, the locomotive, the automobile, and the battleship have no greater coefficient of safety than is required for the modern aircraft.

The need of a very high coefficient of safety resides in the nature of the aeroplane which, being balanced in the air, is capable of great acceleration from the application of great forces which necessitate coefficients greater than any hitherto obtained and which, for some aircraft, can technically assume such high values as to render their construction impossible. Able technicians are today trying to solve the intricate problem and some carry their conception to the point of claiming that the coefficient of solidity of some aircraft can be even a little higher than that of its pilot. Experiments have already been suggested for determining the coefficient of human stability, a coefficient which, for our satisfactions, we may consider from various indications as being quite high.

The very high value of the coefficient of safety now necessary demands the most accurate construction, worked out in its minutest details with materials of the very best quality—a construction which, in order to be light enough, must correspond perfectly to the theoretical conception and, in order that every part will function exactly as designed, every secondary stress must be eliminated and every harmful strain avoided. In general, for every flexure there is a corresponding adjustment favorable to the stability, at least when it is a question of a part being loaded to the point where any distortion indicates the beginning of excessive flexure with consequent collapse. But structures consisting of members loaded axially are ordinarily the lightest and are therefore preferred in aeronautics. Therefore every failure must, in general, he confined within the narrow limits indispensable for the strength of the member involved. The distortions correspond to the moduli of the elasticity and hence are of the greatest importance in selecting the materials to be used in aeronautics. It is not necessary to exclude all materials of great elasticity (the wood for propellers may be all the more desirable on that account), but with a low specific gravity, great strength, a high limit of clasticity and a high coefficient of expansion, there is generally combined a high modulus of elasticity.

After having thus characterized the mechanical properties of aerodynamic materials, we can immediately separate them into two categories. One category includes all those employed in parts requiring continuity of material and which may consist either of a simple covering, or also at the same time of a strong member. The other category comprises all materials especially adapted for strong parts. In this second list, on account of the mechanical properties of the materials, there is found natural extrinsicality and perfect correspondence. In the first list, on the contrary, the condition of continuity makes itself imperiously felt and to this requirement there must often be joined that of flexibility. As things are now, we would be unable to imagine an airship not covered with fabric, or its car not covered with fabric or a thin layer of wood, but, if (aside from the specific case of the envelope of an airship to which we will shortly recur) we concede that the element of shape serves a purpose, we can best employ a covering without flexibility and we can imagine a car, a fuselage, or a wing not covered with fabric, but made of strong material or metal sheets.

The case of the airship is somewhat different from the examples just mentioned, on account of the enormous size of the envelope, which, in order to be strong enough, necessitates the concentration of certain stresses in strong members, which could not be distributed along the whole surface, so that although the resistance to the normal stresses would be possible theoretically, there would still be failures due to secondary and local stresses. The non-rigid envelope is flexible by nature and withstands the stresses by reason of the tension of the inclosed gas, which renders it sufficiently rigid since any force of compression at any point is always less than the pre-existing tension.

Aside from the canvas used especially for airships, the aeronautic materials which we may term non-flexible* and which are used in constructing the framework of aircraft, are: iron, with its binary and ternary alloys; aluminum with its alloys, and wood. To these must be added those which are used for bushings, supports, etc., but these materials, on account of their heavy weight are used in small quantities and only where they are indispensable.

Wood, aluminum, iron and alloys were not equally employed during this period in the various parts of aircraft. The progress in construction made in aeronautics before the war was due almost wholly to the iron and metal industries. These gave us the indispensable powerful and light engines. The first aircraft employed much steel, considerable aluminum and some wood. With the advent of the war there was a great and increasing consumption of metals in war materials, leaving little for aeronautics. This fact, together with the shortage of good mechanics, led to the extensive use of wood and the limitation of metal to those parts where it was found to be indispensable, all the more, because the disadvantages due to the conservation of articles of wood were not felt during the war on account of the necessarily rapid renewal of war material. The problem now has quite a different aspect. The commercial problem has come to the front, and aeroplanes, hesides being safe, must be able to make long trips. Wood presents disadvantages possessed in only a small degree by metals: distortion, due to its low modulus of elasticity; excessive deterioration, from inclement weather; possibility of breaking easily from splitting; lack of homogeneity in density and strength, and ease of absorbing moisture, which diminishes its strength. Hence, as in all other construction wood has gradually yielded to metal, a like change is taking place in aircraft. It is well to remember that the advantage claimed for wood, of greater strength in proportion to its weight, no longer has any value, since I have already shown in a different article (in "L'Aeronautica," March, 1920) that good steels, duralumin, and alloys are, even in this respect, preferable to the best woods for aircraft. We will now make a little closer study of metal construction.

Fully loaded parts not exposed to the wind.—Steel and, to a smaller degree, aluminum and duralumin tubes are suitable for small loads borne for comparatively short periods. Theoretically, this is shown by a formula which includes the thickness, diameter of tube and length loaded or stressed.

1. *The minimum thickness is determined by conditions of indeformability from secondary stresses.*—Both theoretically and practically it has been demonstrated that this minimum thickness is a function of the radius of curvature, and it appears that the minimum thickness should never be less than 1/20 of the radius of the cross-section of the tube. Under these conditions, we assume that we can adopt, for good carbon steels, or ternary steels of 50 to 60 kg. per sq. mm. breaking strength, a safety load of about 1/5 of the breaking strength, while for duralumin the safety load must be kept somewhat lower, probably about 1/7. When subjected to severe tests, such tubes have demonstrated the perfect agreement of the practical results with the theoretical deductions. In Fig. 1 are shown the distortion curves of several tubes which were tested, and it may be seen how little the values registered vary from the distortion curves.

These tubes are not strong enough, however, for great loads and lengths. In such cases recourse is had to complex construction with braced girders. The theoretical conception is simple, but the external construction assumes various aspects. Ordinarily (Fig. 2) three similar members are parallel to the axis of the compressed solid and are connected with one another in various ways, which give the various methods of construction. Thus the steel tubing girders of the first Italian airships were very similar to those used in the Zeppelins (Fig. 3). Not all the connections were suitably made and we improved the construction of the various joints, thus obtaining greater strength for the same weight, and giving us the steel girders (Fig. 4) of our present airships and the dulalumin girders (Fig. 5). The principal difference between the steel and duralumin girders lies in their joints. For the former a good fastening with iron wire or tin solder (Fig. 6) answered the purpose, while the latter had to be joined with at least two rivets (Fig. 7), which necessitated the use of sheet metal members instead of tubes. Aside from the above mentioned manner of bracing, other methods have been employed with equally good results, as shown in Figs. 8, 9 and 10, representing both square and flat girders.

We also show here some results (Fig. 11) of breaking tests. Note how accurate the agreement is hetween the experiments and the theory. Every distortion could have been perfectly predicted.

(*To be concluded*)

* There are also elastic rubber cords which are used as shock absorbers and recall springs.

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NAVAL and MILITARY AERONAUTICS

Chief of Air Service Flies Over Capitals of Three States

By utilizing the airplane, General Mason M. Patrick, Chief of Air Service, was enabled to save several days' time in his inspection trip of fields in the 4th Corps Area. Air Service activities were inspected at Chapman Feld, Miami, Fla.; Carlstrom and Dorr Fields, Arcadia, Fla.; Americus, Ga.; Montgomery, Ala.; Camp Benning, Ga.; and Camp Bragg, Fayetteville, N. C. Traveling by train, it would have taken the Chief of Air Service several days longer to cover the activities which he inspected.

General Patrick, accompanied by Major H. A. Dargue, left Washington on May 19th, and proceeded by train to Miami, Fla., where they inspected Chapman Field. They were shown about Miami and Miami Beach by the President of the Chamber of Commerce of Miami. On Sunday, General Patrick, piloted by Major Dargue, made a 175-mile trip across the Everglades by way of Lake Ocochobie to Carlstrom Field in a JN-6 training plane. After inspecting Carlstrom and Dorr Fields they flew to Jacksonville, Fla., approximately 250 miles distant, in four hours flying time. They landed at Sanford, Fla., for gas and oil, and proceeded by way of Daytonia and St. Augustine, flying about 150 feet above the beach and inspecting the beautiful scenery and resorts along the same. At Jacksonville they were met by two DH-4's which had been sent down from Montgomery, Ala.

On Wednesday, May 24th, General Patrick and Major Dargue flew to Americus, Ga., a distance of approximately 210 miles, in two hours flying time. After inspecting Americus, both the depot and the field, they flew over to Camp Benning, Ga., a distance of 50 miles, and attended the Barbecue incident to the graduation of the class from the Infantry School at that station. They left Camp Benning shortly after lunch and flew to Montgomery, Ala. This trip required 1 hour and 10 minutes, and they passed through several rain storms on the way. The next morning, the 25th, they left Montgomery at 7 o'clock and made a non-stop flight of 6 hours and 25 minutes to Camp Bragg. Fayetteville, N. C., the distance being 525 miles.

After inspecting the Air Service activities at Camp Bragg, they completed the trip to Washington in little less than 3 hours, a distance of 280 miles.

Training Schedule for 23rd Balloon Company

The 23rd Balloon Company, stationed at Post Field, Fort Sill, Oklahoma, started on a training schedule on May 1st, and the following military and technical subjects will be covered by July 1st: Field Service Regulations, Manual of Interior Guard Duty, Infantry Drill Regulations, Telephones, Windlass, Balloons, Machine Guns.

Activities of the 22nd Squadron (Observation)

An official report covering the operations of the 22nd Squadron (Observation) stationed at the Air Intermediate Depot at Montgomery, Alabama, during a period of six months from November 4, 1921 to May 4, 1922, shows that excellent progress has been made. Among the various achievements of this squadron during the above period, particular mention may be made of the fact that a total of 1364 flights were made for a total duration of 448.20 hours, with but one wreck, this being a plane returning from a cross country trip from Birmingham, Ala., which was forced down through inclement weather in a poor landing field. In landing the plane turned turtle, damaging the propeller, wing surface and rudder, no injuries resulting to either pilot or passenger. The plane was subsequently repaired and flown to its home station.

A summary of the work of this squadron is as follows:

	Flights.	Hours
Cross Country	230	220,20
Target and Practice Flights	781	117.15
Formation Flights	13	10.5
Infantry Contact	60	34.20
Communication Flights	80	22
Photographic and Reconnaissance	184	35.55
Bombing	16	8.25
Total aircraft flying time		448.20
Total number of man hours		837.35
Total number of man miles		40,904

During this period the squadron has successfully handled seventeen Infantry contact missions with the Infantry School at Camp Benning, Ga. These missions have required from one to seven planes. To successfully work with the Infantry School, it has been necessary, in a great many instances, to require the pilots and observers to remain overnight at Camp Benning. Twelve lectures have been given the Field Officers' Class, Company Commanders' Class, and Basic Class of the Infantry School at Camp Benning during the present course. Members of these classes who so desired were given a reconnaissance flight over the Camp Benning reservation. This was the first opportunity many of these officers ever had of taking advantage of an aerial flight. Fifty-five members of the Field Officers' Class, seventy-nine of the Company Commanders' Class and forty-six of the Basic Class were given reconnaissance flights, making a total of 180 students at Camp Benning. Ga., who took advantage of this opportunity.

During the last two weeks of February, two officers and ten enlisted men of the Communication Detail, 29th Infantry, Camp Benning, Ga., were ordered on temporary duty to the Montgomery Air Intermediate Depot, where they were given a course of training by the Radio Department of this Squadron in aerial communication. Numerous test flights and special tests, as outlined by the Experimental Department of the Infantry School, were conducted. This training proved of mutual benefit to the two arms, and the officers and enlisted men, completing the course, expressed themselves as being well pleased with the training received.

Eleven recruits were carried by airplane from Montgomery to their permanent assignments at Camp Benning. The flights accomplished were featured by the recruiting officers both of Montgomery and Camp Benning. Local articles were inserted in newspapers throughout the Corps Area as a means of stimulating recruiting for the Infantry School.

The strength of the squadron is 10 officers (8 pilots and 2 observers) and 90 enlisted men. The flying training shown above is in addition to the aerial observation training and military subjects covered during this period by both the commissioned and enlisted personnel in post and unit schools.

Bombing flights have but recently been started, due to the fact that no ground is available at this depot for this training. Arrangements were recently made with the Infantry School, Camp Benning, Ga., whereby the squadron will use one of their many target ranges for this training. This will necessitate an hour's flight from the airdrome to the bombing range.

Conversion of a JN-6H Aeroplane into Ambulance Aeroplane

The Engineering Department at the Fairfield Air Intermediate Depot, Fairfield, Ohio, has completed the conversion of a JN-6H airplane into an Ambulance Airplane. In making this conversion no prints or data were available which were of any benefit in making up a set of prints by which the conversion could be made. Through the efforts of Mr. Herbert D. Penney, of the Drafting Department at the Depot, a drawing and set of prints were made of the proposed airplane and submitted to the Engineering Division at McCook Field, Dayton, Ohio and approved.

The take off is unusually long, due to the excess weight, but the ship handles well in the air, though not as sensitive to the controls as the standard type. The unusual feature of this type of Ambulance Airplane is the location of the physician and the litter. By means of a window, the physician can observe the patient at all times. The litter is easily accessible and can be removed from either side of the fuselage. A special compartment constructed in the fuselage takes care of the first aid kit, instruments or medicines.

The plane is equipped with a standard 31-gallon capacity tank, with an approximate flying radius of two hundred miles. It has a flying speed of from fifty to sixty-five miles per hour, and a landing speed of from thirty to forty-five miles per hour, depending upon the load. As no altitude flight has been made, its maximum altitude cannot be given at this time.

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FOREIGN NEWS

British Aviation

New regulations for securing greater safety on the Paris-London Air route have heen accepted at a meeting of French and British pilots. They agreed to the outward and inward routes being separated by a distance of approximately 10 kilometers (6¼ miles). This arrangement will add slightly to the mileage of the route from London to Paris and necessitates some change in the ground arrangements, including the provision of supplementary landing grounds for cases of emergency. The line from Paris to London will be via Beauvais, Calais, and Dover, while the return journey will he hy Folkestone and Boulogne and then well to the right of the small hills at Cambres and Beauvais.

On Monday, May 7th, the first of the DH-34 machines helonging to the Instone Air Line made the inaugural flight from London to Brussels and back. The actual regular service is scheduled to start on May 15th, and the London-Brussels line may well prove in the future one of the most important radiating from London, linking up England with northern and central Europe.

One of the regular pastimes now for pilots flying between London and Paris on the British machines equipped with wireless is to ring one another up and have a chat in the air.

On Saturday, May 6th, further tests, this time successful, were carried out with the new parachute which is designed to lift a pilot out of a machine falling out of control. This time the tests were made with a triple paracbute, a very small one heing first released, which pulls out a slightly larger one which, in turn, exerts sufficient pull to release the large man-carrying parachute that finally lifts the pilot out of his seat. An ordinary parachute descent was also made.

Two Fokker monoplanes of the F3 type, hut fitted with Rolls-Royce 360 h.p. engines instead of 240 h.p. Pumas, are to be put on the London-Amsterdam service. These machines while retaining the same passenger capacity (five) will have another compartment added for goods and luggage. They are intended to do the double trip in one day.

German Aviation

The Konigsherg-Moscow air service on which Fokker monoplanes are used, was inaugurated on May 1st. At first the service will be bi-weekly, the machines leaving Konigsherg at 9 a. m., arriving at Smolensk at 4:15 p. m., leaving Smolensk at 4:45 p. m., and arriving at Moscow at 7:45 p. m. In the opposite direction the times are as follows: Moscow 6:30 a. m., Smolensk 9:30, leave Smolensk 10, arrive Konigsberg 3:15 p. m. Machines will leave Konigsherg on Sundays and Thursdays and Moscow on Sundays and Wednesdays. The railway journey between Berlin and Konigsherg occupies 12½ hours, and the flight between Konigsberg and Moscow 9 hours, giving a total of 22 hours, as compared with more than five days hy train. The air mail fees are to he 8 marks for post cards and 8 marks for every 20 grammes in case of letters.

The prohihition of German aeronautical enterprise, enforced hy the Entente during 1921, was scheduled to be lifted on May 5. Although the number of aeroplanes in use was negligible during the past year, seven German companies claim to have covered a total of 1,653,053 kilometers during the seven months from April to November, 1921, carrying 6,183 passengers and 30,713,428 kilos of post and parcels. (Commercial Attache C. E. Herring, Berlin.)

Traffic at Bourget

The traffic of the Bourget Aero Station (near Paris) is increasing considerahly, according to La Journee Industrielle of April 9-10. In March, 1922, there were recorded 315 airplanes, carrying 846 passengers and 21,908 kilos of merchandise. The corresponding figures for March, 1921, were 250 aeroplanes with 681 passengers and 8,725 kilos of merchandise.

Belgian Service

The "Sneta," a Government-suhsidised aerial transportation company in Belgium, has finished its trial period of passenger, merchandise, and postal aerial transport service between Brussels and cities in neighboring countries (Paris, London, Amsterdam, The Hague.) Belgian participation on these lines will, therefore, cease from June 1, 1922, leaving the Pais-Brussels and Blussels-Amsterdam services in the hands of French and Dutch companies. A Brussels-London service will he organized hy an English company, beginning in May of the present year.

The Belgian Government studying the creation of a permanent organization which will permit that country to conserve an important position in international aerial transportation.

. Dresden-Berlin-Hamburg

Beginning April 1, a daily passenger, mail and freight air service was re-estahlished on the line Dresden-Berlin-Hamburg and return; also on the line Dresden-Leipaig-Magdehurg-Hanover-Bremen and return. The trip from Bremen to Hamburg takes four and one-half hours, including a half-hour stop in Berlin. The journey to Bremen requires five hours, including 15 minute stops at Leipzig, Magdeburg, and Hanover.

The fare from Dresden to Berlin is 500 marks and from Berlin to Hamhurg 650 marks. This compares with 285 marks and 387 marks, respectively, for the first-class railway fare between the same points. Passage from Dresden to Leipzig is 500 marks and from Leipzig to Bremen 1,300 marks, as compared with 190 marks and 536 marks, respectively, for first-class railway fares hetween these points. Fifteen kiloa of haggage is carried without charge, and all excess at the rate of 15 marks per kilo.—*Commerce Reports.*

Calthrop Parachute Teata at Croydon

Some interesting experiments were carried out at Croydon recently with "Guardian Angel" parachutes. Unfortunately time did not permit of the carrying out of the full programme of the tests, hut further tests are to he made later.

The first drop made was of a dummy man with the "H" type "Guardian Angel" parachute with standard 28-ft. silk body. The dummy man was carried in the new frontal-suspension harness, fitted with instant connector and quick release, the life-line attaching the dummy man to this parachnte being fitted with a small resistance parachute to show the advantage of providing additional resistance to speed up the disconnection of a "dropping" type parschnte in a nose dive.

The test showed that the small resistance parachnte, which was only 4 ft. in diameter, perceptibly speeded up the extraction of the parachute and pulled the dummy man considerahly to the rear of the normal path nsually taken.

In order to avoid any possibility of accident to a pilot or acroplane, it is always preferable to test a new invention of this kind by a series of small advances without accident than to risk damage to the pilot and his machine hy making too hig advances at a time.

Although the reaistance parachute opened instantly, Capt. Muir reported that no shock whatever was felt on his machine, so that on the next occasion it will be safe to employ a resistance parachute of much greater area, in which the effect would be much more marked.

In the second flight the dummy man was dropped with an "H" type parachute, fitted with a newly-invented "Calthrop" hody, provided with three annnlar rings of air pockets, the object of which is to produce enhanced cantilever effect of the compressed air passing under the periphery of the body, and thus giving additional resistance. Again, in order to proceed without them for the sake of safety to the pilot and the machine, the air pockets were contracted to about one-tenth of their full extension.

The opening of the body was extranrdinarily quick, but perfectly elastic; and again Capt. Muir reported that there was no shock whatever to his machine. The resnlt of the experiment was to show that the rate of descent was appreciahly slower.

Aviators to Fly to Picnic

The first aerial picnic on record will take place in Paris, when thirty-five aeroplanes, hearing most of the famous pilots of France and the present and former Air Ministers and their wives, will take off from the Buc, Villa Couhlay, Issy-les-Moulineaux and Tonssus-le-Noble acrodromes for a landing field at Tillieres, sixty miles from Paris. Here a luncheon will be served from baskets hrought on the planes.

Capt. Rene Fonck, with Under Secretary of Aviation Eynac as passenger; Adjntant Jean Casale, with Senator Flandin, former Aeronautic Secretary, and Mme. Flandin aboard, and Sub-Lieut. Charles Nungesser, carrying Count de la Vaulx, will form part of the group. Other aviators who will make the trip are Lieut. Bossoutrot and Sadi Lecointe.

The London Aerial Derby

The *New York Herald* correspondent states that the air will he "lashed into a frenzy" at Hendon when the aerial pageant takes place there June 24. Unbeard-of stunts have been planned and the speed laws of aviation will be hroken. The mystery planes belonging to the Air Ministry will take part and give the puhlic the first opportunity to see these new planes designed to operate in conjunction with the hattleship fleet. These amphihians are made for channel traffic as well, and as soon as an aerodrome on the Thames is erected they will also be seen there.

The most striking feature of the program will he massed aerial attack on an improvised desert stronghold. No detail has been spared to make the structure realistic. There are palm trees, loopholed minarets and lookout towers that rise to a height of 100 feet from within a high walled fortress equipped with guns. The defenders will wear Eastern costumes.

For fifteen minutes a hattle will rage between an armed squadron of bomhing planes and the defenders. Later Lieut. W. H. Longton will give an exhibition of "frenzied flying" and stunts near the ground.

Rumania Accuses Reds of Propaganda by Air

Formal protest has been sent to the Russian conference at The Hague hy the Rumanian government, which declares Soviet Russia has violated the non-aggression pact hy sending propaganda into Rumania by aeroplane. The government has made specific complaint relative to the recent capture of a Bolshevik machine and its crew near Tichina.

The New Russian-German Air Linas

On May 1st a most important development in air transportation was inaugurated hy the opening of a direct and regular service between Konigsherg in Eastern Germany and Moscow. During the coming months the line is to he extended to Berlin and the service will become a daily one in both directions. The importance of this development lies in the fact that the line is one of the very few, perhaps the only one, which is an undoubted economic necessity, all previously existing means of communication hetween Russia and Germany being in a state of chaos through the war and its aftermath.

At the present time it takes about 5 days, and a considerahle amount of persistence, to travel between the two capitals. The mail takes an average of eight days and even telegrams four days in transmission. The section already in operation, Konigsberg-Moscow, a distance of 780 miles, is flown during the day, in two stages of four hours each. The airline shortens the trip to 30 hours.

For the present, the entire passenger and mail space has been reserved hy the German and Russian Governments for the use of couriers and the carriage of official correspondence and documents.

Although operated hy a German company, hacked hy several of the greatest German industrial and shipping interests, the planes used are made in Holland and the motors are English. Ten Fokker F 3 monoplanes of the latest type were huilt at the Netherlands Aircraft Mfg. Co.'s plant at Veere, Holland, and successfully delivered hy air. They are fitted with 340 h.p. Rolls Royce motors and develop a speed of 115 miles per hour. The cabin arrangements are even more complete than in the 3 machines which are so well known in this country. A large haggage compartment has been added behind the cahin, and for the use of the couriers 3 sleeping berths are provided, which can instantly be converted to seats for 6 persons for use in ordinary day time traffic. A very effective arrangement for heating the cahin with clean, warm air is also installed.

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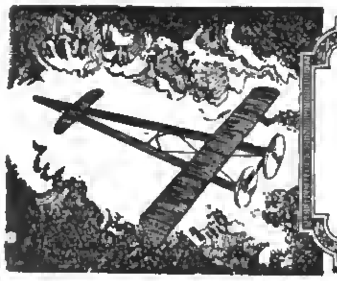
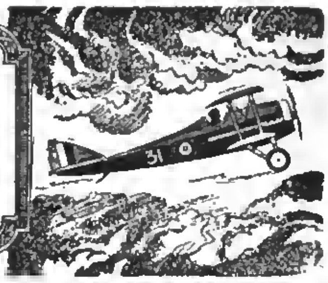


ELEMENTARY AERONAUTICS *and* MODEL NOTES



Details of Illinois Model Aero Club Models

(*Continued from Last Week's Issue*).

Bending Bamboo

A few simple rules will help an amateur to bend bamboo. First, use *good* bamboo; not old dry rotten stuff; scrape the hard outside off as well as the soft inside and hold it near the flame, either to one side or above, and move the piece back and forth until it commences to bend. A, can be made much longer than B. and still not warp easily. If it does commence to warp it can be straightened easily. The cross-piece in A keeps the top-piece from sagging under the pull of the doped paper.

Adjustable Wing Clips for Scale Models

These clips make it easier to adjust the wings. Wire hooks C-C with two loops are fastened over the wing LD. Aluminum strips A-A bent double are fastened to wing struts B-B and then drilled twice as shown. Similar attachments to the rear complete the unit. With this arrangement the wing can be moved backward or forward and also be warped.

Double Surfaced Wings

Double surfaced wings are more efficient than single surface but are much harder to construct. A is the beam which, if pine, should be close to 1-32 inch thick. The height of the beam depends upon on the wing section chosen by the builder. E are the ribs, which are formed as close as possible to the section copied. Ribs should be made 1-64-inch sq. to 1-32-inch sq., according to the size of the wing, if the material is of bamboo. If the ribs are of balsam 1-16 inch, they should be about strong enough and can be hollowed out like the ribs of a large machine to make them lighter. Two bamboo pieces, B, fastened to the end of the wing-beam enable it to stand any shocks it receives in landing. If the brittle white pine were extended to the end of the wing it would very likely snap off the first time the tip received a severe shock. C, is the wing tip which should be bound as shown to the wing beam D, at the point F. Entering edge D is fastened to the ribs E as shown directly above the drawing of the wing tips. An expert with Ambroid can do this operation without binding. Entering edges 1-32 in. in diameter will stand the pull of a lightly doped wing with ribs about 2¼ inches apart. The paper can be stuck on the frame with either Le Page's glue or banana oil, and the surplus paper around the edges cut off with a sharp razor blade. Either one or two wing beams can be used in a double cover wing.

Scale Model Nose No. 2

This model nose is familiar to I. M. A. C. members. To the nose C is attached the block H, to hold the motor-base in place, by means of the wire spring E, which is looped under pins D, which are inserted in the nose. The dress snaps A are fastened to the balsa nose C by wire, thread, and glue. The other half of the dress snaps are lined up on the body in the proper place.

Scale Model Nose No. 1

Model Nose No. 1 is the same type that is used on the S. E. 5 scale model which was built by Mr. Jaros and flew so well. A is the balsa nose into which are inserted the wires E with snap style of end which does not pull out of the tube T easily. This can be made of aluminum sheet rolled if no other is suitable. To the nose A is also permanently fastened the two bamboo strips C, on each side of the hole for the motor-base. The motor-base is thus detachable. To the motor-base B is fastened the cross-piece D. The front of the nose is rounded to cut down resistance.

Wheels

Balsa wheels present a realistic appearance and are not so hard to make if one has an electric motor around the house. The rim is turned out of balsa by using sandpaper as a tool. Then the stiff paper sides C and D are glued in as shown. Side D is one thickness of the stiff paper made into the form of a cone by cutting out a pie-shaped piece and gluing the edges together. The washer E is then glued securely to the centre to be the bearing of the wheel. Another similar piece of paper is glued over the first to make two thicknesses for strength and this is followed by another washer. The hole at the center should be large enough to permit a large diameter pin to pass through and form the axle.

The paper wheel is easier to make. It is built up of two sides formed of the familiar cones which are glued together at the edges. Washers are glued inside at the center to form the bearing. They should be spun on an axle and trued before the glue sets.

The balsa and paper wheels are suitable for scale models. The small paper wheels are suitable for R. O. G. twin pushers but the small cork ones are better yet. A piece of balsa could be used in place of the cork piece B. Washer bearings are used as in the other wheels. D are the supports to which the axles are attached for use in twin-push R. O. G. machines.

The Preservation of Model Rubber

The rubber strands used for motive power on model aeroplanes is kept in good condition longer by keeping it well covered with soapstone when not in use. The rubber should be powdered after every five or six flights with graphite, soapstone, or a mixture of both. Graphite is the best but is dirty to handle. In making up the motors for a model it is necessary to make a joint in the rubber. The best way to do this is to tie a squore knot in the rubber and roll it until it is securely tight. In keeping rubber, light should not be permitted to reach it and oil should be kept from it, for they will injure rubber.

The Illinois Model Aero Club

Mr. M. L. Bramberg, chairman of the Contest Committee of the Illinois Model Aero Club announces that his club is trying to get up a National contest for model aeroplanes during the Pageant of Progress to be held in Chicago from July 29th to August 14th.

It is their desire to offer cash prizes and trophies for different kinds of contests and to secure the co-operation of all other model aero clubs throughout the country.

Letters have been written to all the model clubs, but few have replied. Mr. Bramberg says the boys of the I. M. A. C. are beginning to believe they are the only ones in this country who can build record models and in order to find out if this is a fact or not, it will be necessary to establish a contest of this kind. The other model clubs should take up the challenge and a lively contest is sure to result.

The Illinois Model Aero Club has its headquarters at 430 South Michigan Avenue, a club room on the Parlor Floor of the Auditorium Hotel (care of the Aero Club of Illinois—phone Harrison 3289) and the flying field is at Cicero Avenue and 83rd Street, Chicago, Ill.

World's Records of Model Aeroplanes

Tractors

Type of Contest	Record	Record Holder
Rise-off-ground, Duration	227.4 seconds	Breckenridge
Rise-off-ground, Distance	2685 feet	Breckenridge
Hand-launched, Duration	240 seconds	Lathrop
Hand-launched, Distance	2465 feet	Pond
Rise-off-water, Duration	116 seconds	Hittle

Twin Pushers

Type of Contest	Record	Record Holder
Rise-off-ground, Duration	170 seconds	Lauder (N.Y.C.)
Rise-off-ground, Distance	4029 feet	Schweitzer
Hand-launched, Duration	230.8 seconds	Schweitzer
Hand-launched, Distance	5337 feet	Hall
Rise-off-water, Duration	118 seconds	Likosiak

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RADIO DIGEST

Control Aeroplane Flight by Wireless in France

In addition to controlling the flight of an aeroplane by radio, attempts are being made in France to devise mechanism to enable a plane not only to ascend pilotless, but also to land without any hand on the controls.

Devices in course of perfection show wonderful ingenuity. In one case, a machine without a pilot, its engine having been started, runs across the aerodrome, causing to revolve at a rapidly increasing pace a small two-bladed fan or screw between the wings. The fan, as soon as it turns a certain number of revolutions, actuates mechanism which places the control surface of the machine in the right position for ascent, its maneuvers while aloft being controlled by wireless.

When the time comes for landing a signal has the effect of unrolling beneath the aeroplane a length of wire with a weight at the end. This weight, touching ground while the machine is at some little height, switches off the engine and causes the rear surfaces of the plane to set themselves in such a position that the landing wheels of the machine make a smooth contact with the ground.

French radio control of aeroplanes has achieved already a notable triumph. A large machine was taken up by its pilot, who left the controls and allowed the machine to be maneuvered for more than an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Radio Success Depends on Details

Attention to details which seem unimportant has made it possible for many a home-made radio set in the hands of a careful operator to establish a long-distance record or clearness of signals far superior to the attainments of an elaborate outlay of instruments under the operation of a careless operator. In radio receiving a feeble electrical current is being dealt with, and the little things which seem almost insignificant count to a great extent in successfully developing a weak signal to audibility and a loud signal to marked intensity.

A straight copper wire, size No. 14, about 100 feet long, serves as an excellent antenna for receiving radio broadcast news or music. The outside antenna is subjected to the elements of the weather, and it also is in a position to swing about in the wind. All aerial connections should be soldered firmly, thus affording good electrical connections and keeping joints free of dirt, which is likely to serve as insulation. If antenna connections are not soldered the result is certain to be loose connections when the wind blows. The antenna should be well insulated and free from all objects. Otherwise, especially in damp weather, much of the energy, if not all, will find its way to the ground before reaching the receiving instruments. The antenna wire can be either bare or covered with insulation. It is important to connect the ends of the wire to insulators instead of direct to the spreaders or poles, because wood when wet is a good conductor of electricity. The guy wires also should be broken up by an insulator. Never erect the antenna parallel to telephone or electric light wires, as interference by induction generally results. In many instances where radio wires have paralleled a telephone line the regular phone conversation has been heard in the wireless receivers.

The ground connection should be soldered or clamped securely, instead of carelessly wound around a pipe or rod which leads to the earth. Before the connection is made the pipe or surface to be connected should be thoroughly scraped and cleaned. A faulty ground connection has hindered many a fine radio set from producing clear signals. A copper boiler or sheet buried several feet in the earth serves as an ideal radio ground because it has considerable area. Surround the copper surface with charcoal and sand, as such a combination tends to hold moisture around the metal, making it a more efficient ground.

The next best ground and easily within the reach of all is the cold water pipe. The next selection is the radiator, and then the gas pipe. Architects, when planning a home, may soon provide for a radio ground connection. A sheet of copper could be buried underneath the cellar floor and the connection extended to the baseboard sockets in the music room, living room or any room in the house where a radio set might be used.

All connections in a radio hook-up should be soldered whenever possibie. By constant turning of the knobs and dials the wire in time will work loose and trouble result. Sliding contacts and switch points always should be kept clean, as dust and grease are sure to accumulate and serve to insulate the electrical connection. It will be surprising how neatness, cleanliness and attention to details in radio work make possible increased range and intensity.

Efficiency of Indoor Aerials

The greatest mystery of radio, in the minds of many people, is that the signals can be intercepted by an aerial inside a building without even a window being open. The results with an indoor antenna are not as satisfactory as when the antenna is in the open. Nevertheless, with a step or two of amplification remarkably clear, signals may be heard by the use of an indoor antenna. A wire extended down the hallway and hidden behind the molding will give astonishing results.

Little do we realize as we sit in our homes reading the papers that the latest news of the world is passed before us—in fact, right through our bodies—at the speed of 186,000 miles a second. Every minute of the day and night invisible radio waves rush through our homes and offices, carrying the melodious strains of bands and orchestras; the voice of a speaker far away, or the dot and dash of a ship in mid-ocean. The messages of the world are ever present just like the medium which transports them —the ether.

Ether is an invisible, odorless, tasteless substance found everywhere from the most perfect vacuum to the highest and greatest mountains. Therefore, anything traveling with such a substance as its medium of transportation goes through everything and thus radio travels unseen, showing no preference, through the millions of homes in the world. A little receiving set connected to a wire inside the house will prove that there is more truth than poetry in the lines of the old song, "There's Music in the Air."

Radio Wave Lengths

The distance a radio wave travels does not depend upon the length of the wave, as many people think. The power of the transmitter and the sensitiveness of the receiving apparatus govern to a great degree the distance the signals may be heard, and atmospheric conditions also play a part. A short wave may travel thousands of miles, but it is not capable of carrying high power and, therefore, the message carried on a low wave length weakens as it gets further from its origin.

A wave length is the distance from one point in a wave to the next point in a like phase; in other words, the distance from crest to crest. Long wave lengths are used for long distance work because low frequency currents carry far better than high frequency currents, which make up the shorter waves. Wave lengths are measured in meters, a meter being 39.37 inches. When the instruments are tuned to receive a certain wave length they merely pick up sounds of a definite number of vibrations. Enemy submarines during the war used as low as 75 meters for transmission, and the powerful station at Nauen, Germany, used a wave of 12,600 meters.

The Lafayette station near Bordeaux, France, uses the longest wave of any radio station in the world at the present time. It is 23,000 meters, about fourteen miles in length. Second place belongs to Long Island Central—19,000 meters. This is approximately twelve miles from crest to crest for a wave leaving the Long Island station. The distance a message travels from Long Island to Germany is about 4,000 miles. Thus, there are a trifle more than 333 complete dips or troughs in the distance between Long Island Central's antenna and Germany's wires. Arlington, Va., sends time signals on a 2,500-meter wave. Radio telephone broadcasting from WJZ, Newark, and the majority of other broadcasting stations, is on 360 meters.

Care of the Storage Battery

A storage battery might be termed the heart of a radio receiving circuit when the vacuum tube is used in place of the crystal detector, as it renders the life-giving current to the hook-up, which is merely the veins and arteries of the receiving set.

The storage battery—or, as it is called in radio, the "A" battery—must receive a certain amount of care and attention if it is to produce efficiently over a reasonable period of years. The development of radio equipment during the last year or two has made it possible for operators of audion sets to charge their own batteries, and it must be remembered that violent discharging and excess overcharging shortens the life of the cells, causing injury to the plates by warping or buckling.

Distilled water should be added to a battery at least every two weeks. The electrolyte, which is a definite mixture of chemically pure sulphuric acid and pure water, should not be permitted to fall below the tops of the plates. Exposure of the plate tops induces sulphation, a chalky deposit, which is a non-conductor of electricity, thus causing internal resistance. During the summer months it is well to add water once a week, as evaporation is more rapid in warm weather. Care must be taken not to raise the electrolyte level too high above the plates, as the solution is apt to slop over

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and cause a short circuit on the exterior of the battery. The electrolyte also will eat the case and sulphate the terminals. This may be prevented by wiping off the terminals with a vaseline-covered rag. It is a good rule to keep the electrolyte level about one-quarter of an inch above the top of the plates, and always keep the top of the battery case dry and clean.

Idleness is bad for batteries, so if the reader goes away during the summer months the radio storage battery should be left in the care of a battery service station and charged at least once a month during periods of idleness.

It is always well to have a syringe-hydrometer as part of a radio equipment. Such an instrument indicates the condition of the storage cells. The power of a storage battery gradually diminishes as it is used, but after a certain point of discharge is reached it weakens quickly, without any advance notice, and in such a condition is of little service to the audion. Therefore, it is well to test the specific gravity of the cells from time to time. A musical concert may hold special interest some night, and it is aggravating to have a battery weaken on an occasion when its best performance is needed.

To test the specific gravity of a cell, remove the vent, insert the tube at the bottom of the hydrometer syringe into the electrolyte. Squeeze the rubber bulb, then remove the pressure from the bulb. Electrolyte will rise in the glass barrel. Read the figure reached by the surface of the electrolyte. The figure 1.285 is the "full charge" for battery specific gravity. The figure 1.270 indicates one-quarter discharged. The reading 1.255 shows that the battery is half discharged. At 1.225 the battery should be charged.

After the reading is noted, squeeze the bulb to expel the liquid from the tube and always restore the electrolyte to the cell from which it was taken—never to another. Always take the hydrometer reading either before adding water or after there has been an hour or two of use to insure thorough mixing. Water mixes slowly with the electrolyte since the acid is the heavier.

The Buzzer Test

In using a crystal receiving set the first operation is to adjust the detector; that is, find a sensitive spot on the mineral, generally a piece of galena. All crystals have good and bad spots and therefore a fine wire which makes contact with the surface of the galena must be moved about until a sensitive spot is located. After the select spot is discovered the detector is all set to perform by permitting the passage of the feeble high-frequency wireless currents through the phones and causing the diaphragm to vibrate, producing a sound audible to the ear of the operator.

When an operator opens the crystal set for "listening in" he must adjust his crystal by the music or signals passing through the air, and by doing this a part of the concert is lost. A buzzer test serves to have the apparatus adjusted to its maximum degree of sensibility when the broadcasting concert begins. An operator might sit for hours "listening in" with the idea that the crystal detector was finely adjusted and still have the contact wire off the sensitive spots. When a buzzer test is used the operator can press the button or close the switch which completes the buzzer circuit at any time and thus be assured that the set is perfectly adjusted. The buzzer merely sets up vibrations in the receiving set which are used as a substitute for radio signals.

Getting Results from Home Radio

Radio receiving has passed the experimental stage and reached the point where it is a source of amusement, pleasure and instruction to the average person. As a matter of fact, the majority still regard radio as a means of receiving, rather than transmitting.

Roughly speaking, there are three types of receiving sets today, each with many modifications and varieties. The best known and least expensive is termed the Crystal Set. Many amateurs have constructed their own sets of this type, or they can be purchased complete. The radius of operation and efficiency is limited, ordinarily, to within twenty-five to fifty miles of the broadcasting stations, and requires the use of head-sets, without permitting the use of a loud speaker.

The next set is called the Audion or Vacuum Tube, with a range up to 500 miles if only one detector and one amplifier be used. By increasing the number of tubes the radius can be extended to a thousand miles or more.

The third type embraces the vacuum tube, the cabinet also containing a regulation phonograph equipment, whereby the one instrument, at the will of the owner, can be used for the receiving of wireless messages or the playing of phonograph records.

Knowledge

"Listening in" is far more enjoyable and much better results can be attained when the sets are understood in greater detail, and how and why the various instruments are used, rather than by "just turning a knob or a dial."

Function

The function of a receiving set is to absorb the energy from the passing electromagnetic waves sent out by the broadcasting stations in the form of what is technically termed radio frequency oscillations, and then to transform this energy into audible sounds, be it music, speeches, or what not; in other words, to make it possible to hear clearly and distinctly.

Construction

The principal parts of a receiving set include the antenna, or aerial, which is a copper wire that intercepts or catches sound waves. Satisfactory results require at least one hundred feet of wire. With the improvements in amplification, it is now possible to use indoor aerials with splendid results. It is said that a well-grounded aerial will protect a whole city block from being struck by lightning.

The antenna transfer switch, which serves to connect the aerial with the set itself, is another important unit, and telephone receivers, commonly called head-sets, are essential. Radio phones are said to be of high frequency because of the great length of fine wire used in their coils, but, as this wire is always the finest copper, the resistance of a good phone may be as low as 2,000 or 1,500 ohms. The ohm is the unit of resistance. As a matter of comparison, the average telephone receiver is less than 100 ohms. The cross-sectional area of the radio phone is low; therefore, higher resistance is not wanted, but cannot be avoided. A few turns of German silver wire would produce 2,000 ohms resistance, but no magnetizing effect.

Radio phones have permanent magnets to keep the diaphragm under a constant strain, to prevent hysteresis (heat) losses. They will not operate on oscillating current, because the inductive reactance is too great and the current cannot pass through the phone. Even if the current could pass, the diaphragm could not vibrate so fast, and if the diaphragm could vibrate at that speed the human ear would be unable to hear it.

The loading coil, which makes it possible to increase the wave length of the set, thereby enabling the user to hear a greater number of stations.

The receiving transformer is designed to transfer the weak oscillations of extremely high frequency from one circuit to another. In the words of the layman, this merely means a finer tuning, eliminating interference of other stations.

The detector apparently is the most important part of the set to the average person. It rectifies the incoming oscillations of the wave train into direct pulsating currents, thus enabling operation of the phones at audible frequency.

The broadcasting stations transmit sound waves, termed radio frequency, at a rate as high as 100,000 oscillations a second, but the human ear cannot hear in excess of about 1,000 a second. Therefore, the detector actually transfers the waves from radio frequency into audible frequency.

When the condenser, which controls wave lengths, is put in series with the ground it tends to shorten the wave length. Placed in parallel to the open circuit, it permits the reception of longer waves. Placed parallel to the closed circuit, it is used to bring the secondary into resonance with the primary. Placed across the phone, it stores up the rectified oscillations and then discharges them through the phone with cumulative effect.

The buzzer circuit, which enables the operator to adjust his detector in advance to the maximum degree of sensibility, gives assurance that a calling station can be heard.

The safety or micrometer gap is connected across the aerial and ground terminal to prevent static discharges or strong near-by signals from throwing the detector out of operation.

The amateur, to increase his knowledge and obtain the best results, should study radio in the following order: Construction, arrangement, operation, function, care and principle of operation.

Detector

The crystal detector is mentioned so often that it is worthy of description. Galena is the most used mineral and is the best for the reception of weak signals. It is the most suitable for the set of short range. Carborundum as a detector is very stable and not affected by strong currents, but fails to be a good rectifier. Silicon is not as sensitive as galena, but is a better rectifier than carborundum. A sharp point of antimony pressing on silicon gives good results, but is not as sensitive as galena and will not give as loud and clear signals.

Audions

The simple audion or vacuum tube circuit consists of five parts—the bulb, containing three elements; the filament, the grid or zig-zag wire, and the plate, which is solid metal; high voltage or B battery; low voltage or A battery: rheostat for control of the A battery voltage; condenser in series with the grid.

The primary advantages of the audion compared with the crystal is that it is more sensitive, is not so readily put out of adjustment, permits receiving from broadcasting stations at a much greater distance, and enables the use of a loud speaking horn, whereby sounds carry clearly in a large room and in auditoriums.

Coupling

Coupling is the method of transferring the energy absorbed by the aerial from the primary to secondary. It permits a finer tuning, thus preventing interference when two or more stations are broadcasting simultaneously on a similar wave length.

Close coupling results in a larger transfer of energy from the primary to the secondary, and the circuits need not be in resonance. It is used for "listening in," as many wave lengths can be heard without readjustment.

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Loose coupling gives a smaller transfer of energy from the primary to the secondary circuits. With this type the circuits must be in exact resonance. It is used in tuning out or preventing interference, as only one station and one definite wave length can be heard well.

The primary circuit is used for the original or crude tuning, which is transferred by mutual induction to the secondary circuit, which in turn gives the finer tuning.

When the broadcasting station and the receiving set have the same wave length they are said to be in tune or in resonance. Where the wave length is different, naturally there must be an adjustment on the part of the receiving set.

The characteristics which determine the efficiency of the receiving set are: Range—detector and phone; audibility—condenser; selectivity—coupling.

To tune a receiving set to a distant broadcasting station it is necessary to adjust detector to its maximum degree of sensibility by means of the buzzer circuit. Set the secondary to approximately the desired wave length, using large values of inductance and small values of capacity. Increase or loosen the coupling. Add or subtract inductance and capacity in the primary circuit until response is heard in the phone. Loosen the coupling until interference is eliminated or reduced to a minimum. Try new values in both circuits until the loudest sounds are heard with a minimum of static and interference.

If the secondary circuit is calibrated, it can be set at once to the desired wave length. The primary is not calibrated, due to the fact that no two aerials have the same wave length. After installing a set to a certain aerial, the operator can make proper calibrations on the primary.

Field Locater Makes Travel by Air Safe

Radio and flying are inseparable. This vital fact is becoming more and more evident to those engaged in the development of commercial aviation. Radio has already removed the terrors of fog from aerial navigation and has made night flying possible. Without night flying no system of civil aerial transport will ever be successful.

In a recent article on this page the work of the United States Air Mail Service was outlined. This service has done some remarkable pioneer work in the development of radio as an adjunct to aerial navigation, and of this work there is no question that the field localizer is the most important of all.

It is one thing to guide an aeroplane safely through a fog to the place where the pilot of the machine desires to go and quite another to bring the ship safely to earth. This fact was demonstrated in the transcontinental air race two years ago, when the big Martin bomber was caught in a fog between Des Moines and Omaha. Her pilot used all his skill and judgment in bringing the big machine to earth, but was unable to avert a crash. His skill reduced the seriousness of the forced landing, but did not prevent the subsequent crash.

Fog Chief Danger in Flying

There is no more embarrassing situation for the pilot of an aeroplane than to be in a dense fog at the end of his journey without fuel. It is impossible to remain in the air, and yet he does not know the nature of the ground below him. A crash under these circumstances is practically inevitable.

With this situation in mind, the engineers of the United States Air Mail Service started three years ago a series of experiments designed to eliminate this danger from the art of aerial navigation, and they naturally turned to radio as the means to achieve their object.

With the experience of the radio direction finder before them, they know that electro-magnetic waves could be sent out in one direction with certain types of transmitting equipment. Now, the logical inference was that if apparatus could be developed which would shoot a beam of electro-magnetic waves vertically into space, a pilot would be enabled to tell just when he was over the center of the landing field where he desired to alight. This is the basis of the radio field localizer, which was subsequently successfully developed.

System Not Perfected

The perfection of this apparatus did not, of course, come immediately. It followed a series of careful and persistent experiments, which at first were far from successful. The system, however, has now been perfected, and will soon be in general operation at all of the air mail flying fields, in accordance with the radio expansion program which the chiefs of the service are now engaged in promoting.

The official description of the apparatus is as follows: "The localizer is a device for transmitting radio signals more or less vertically, so as to form an electro-magnetic field over the landing field itself, and extending to a sufficient altitude to enable the pilot to intercept this zone of sound above the clouds or fog."

When the experiments were first started, efforts to achieve the end in view were made with a current of audio-frequency. Coming back to the official description, we are told: "This device consisted of a single turn of wire of fairly large diameter, with weather-proof insulation, which was laid around the outside of the flying field.

Audio-Frequency Used with Loop

"In actual experiment this turn—or loop—was 2,500 feet in diameter. It was found that when the output of a 500-cycle generator was supplied to this loop directly with key modulation, an electro-magnetic field was produced in the form of a cone whose area decreased with altitude. The uppermost effective limits of this device were around 3,000 feet."

For practical purposes this system was not successful, as a study of the results obtained will show. As described above, the electro-magnetic field above the loop aerial was in the form of a cone with the apex in the clouds. Now it will be readily seen that an aeroplane flying at normal altitudes would have extreme difficulty in passing through the zone of the electro-magnetic field, and it would be only the merest chance that he would happen to strike it. Machines flying at greater altitudes than 3,000 feet would not pass through the magnetic field at all.

There was another disadvantage to this system, and it lay in the fact that as the cone of the magnetic field was pointing upward, the width of the field was greatest at its base, which, of course, was on the ground. This meant that as the pilot came closer and closer to the ground the more uncertain he would be as to just where the center of the landing field was located.

An Inverted Cone Needed

From this it will be seen that what was needed was an electro-magnetic field in the shape of a cone; whose base was up in the clouds and its apex on the ground.

The next experiments designed to achieve this result were made with currents of radio-frequency. The device used to accomplish this result has been standardized and is the so-called "field localizer." Reverting back to the official description, we find the following:

"This device consists of two loops, each with a single turn, separated by a distance of about twelve feet, wound parallel to the earth's surface. A radio-frequency current is used, which flows through these coils in opposite directions.

"In actual practice these coils are wound around a wooden hangar, from which they are carefully insulated. As stated, a radio-frequency current is used in this device with key modulation. The resulting electro-magnetic field takes the form of a cone whose size increases with altitude, so that at a height of 3,000 or 4,000 feet the diameter of the cone is over half a mile."

It will be seen at once that this is the ideal situation, because the greatest area of the electro-magnetic field is where it is most needed—that is, at high altitudes.

Pilot Can Lay Straight Course

Now, the pilot caught in a fog can determine his exact location by means of his wireless compass, or radio direction finder, and he will then know how far away he is from his home field and what direction the field is bearing away from him. He can then lay a straight course for the field.

He then has to pass into the zone of the electro-magnetic field of the localizer, and with known current strengths he can pretty well estimate his altitude above the field, especially with the aid of his altimeter. The wonderful part of the inverted cone electro-magnetic field of the localizer is that it enables the pilot to spiral down slowly and gently along its outer edges until he can discern the outline of the landing field below him.

It has been found in the experimental and practical work with this device that the ordinary direction-finding apparatus installed on the aeroplane can be used successfully with the localizer. This is a very important thing, because it reduces the amount of apparatus necessary on the aeroplane and correspondingly keeps the duties of the pilot within reasonable limits.

The experiments with the audio-frequency currents which were first carried out made it necessary to install separate coils around the outer edges of the lower wings. This was unnecessary with the radio-frequency currents.

The field localizer and the radio direction-finder have eliminated the last preventable causes of danger to aerial navigation, and what is more important, they make night flying an actuality.

In connection with the immediate plans of the Air Mail Service, Colonel Paul Henderson, Second Assistant Postmaster-General, makes the following statement:

"We have come to the conclusion that the air mail has reached its limit operating only by day, because the railways afford a twenty-four-hour-a-day service. For several months we have been arranging for night flying. Two big tasks were to be done; one, equipping of all mail planes with radio; and second, establishment of aerial light-houses or electric beacons and flood lights at emergency and regular mail fields, at approximate distances of thirty to forty miles, all the way across the continent between New York and San Francisco. We are doing these things at present.

"Our fourteen main fields are equipped with radio stations, and we hope to have the first of the planes equipped with radio shortly. They will have wireless telephones and radio direction-finders. By using the direction-finder a pilot will be able to keep on his route in darkness, storm or fog, and the beacons at his objective will guide him directly over the field when the floodlights will be turned on, enabling him to land as easily as in daylight.

"We have already carried the mail from coast to coast in less than thirty hours, and we think we can provide steady service of this sort. It will be important, too. For example, mail leaving New York after the close of business will be delivered in Chicago before business starts next morning.

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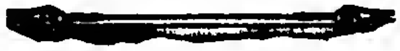

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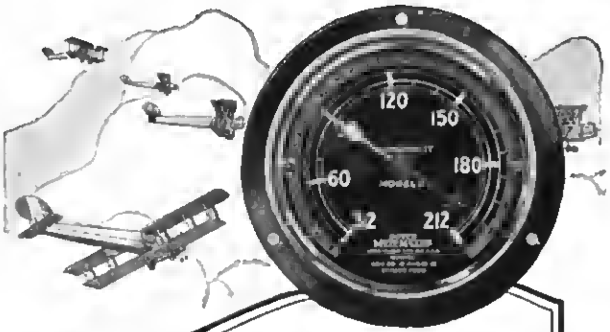

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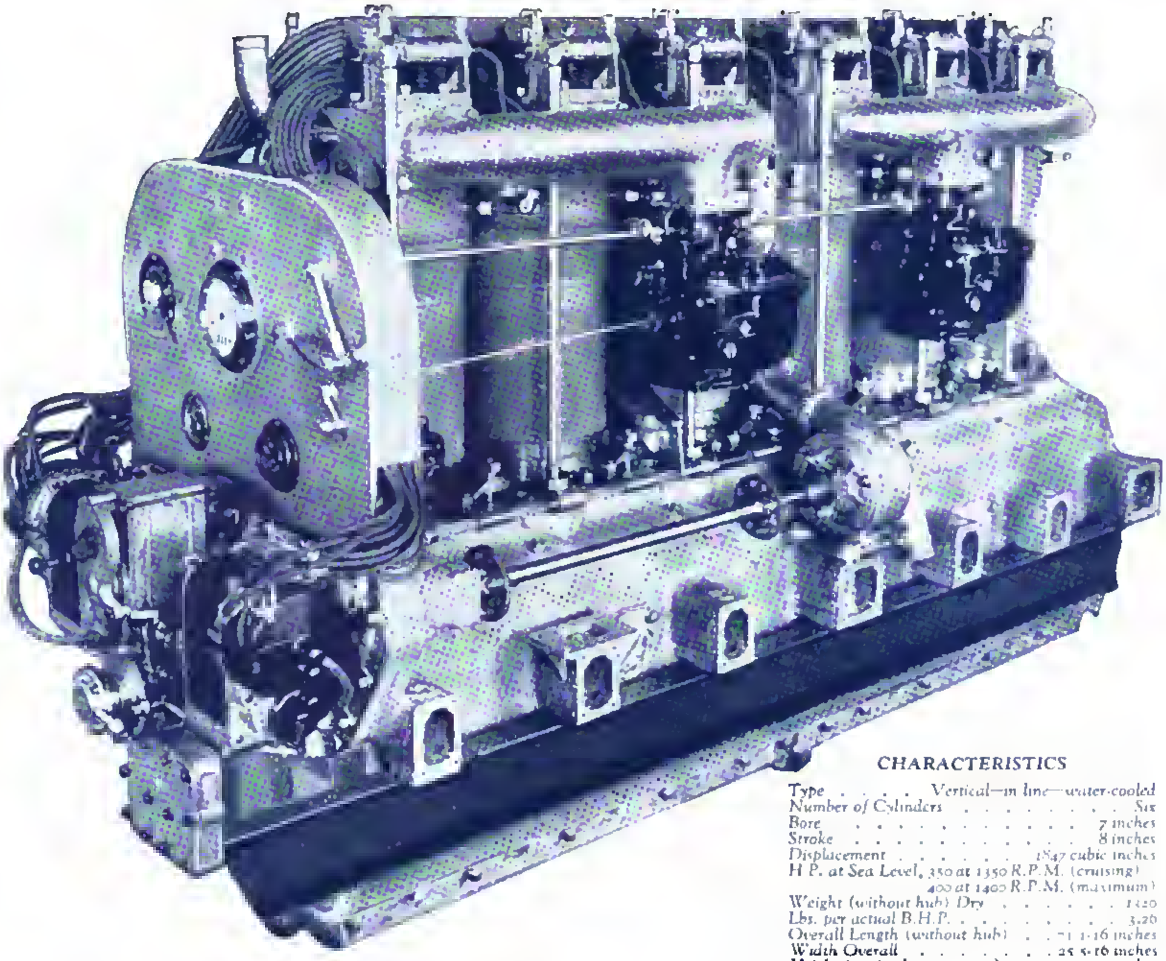

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Commercial and Military Aeronautics

By WILLIAN KNIGHT, M. E.

SEVERAL criticisms have been made from time to time on the matter of the more or less perfect adaptation of the military flying machine which was practically born and developed during the war to the needs of post-bellum commercial aviation.

"The Commercial aeroplane does not exist in America" was the surprising statement attributed to one of our best flyers a few weeks ago after unsuccessfully attempting a cross-country flight on a good machine which has successfully stood the more severe tests both in Germany where it was born and in this country where it has been adopted by Larsen.

It is out of question that the commercial aeroplane of to-day is far as yet from being the ideal means of transportation in the air, but this is not a good reason for condemning the present day commercial aircraft and for casting a shadow of doubt on its present and future possibilities.

So far as commercial aviation expenditures, even in France where the Government has taken an active interest in its development that has not been equalled by any other government, have stood a very poor comparison with military aviation expenditures. Two hundred and forty-six millions of francs for military aviation and forty-five millions for commercial aviation are such figures that explain quite eloquently why the military flying machine has progressed since the war at such a rate which cannot be compared to the progress made by commercial aircrafts.

To this country, the comparison is even more discouraging because the only money that we are opening at the present time for commercial aviation is the money which is being spent for keeping alive what remains of our air mail service.

The development of a truly commercial aircraft, quite evidently requires money. Aircraft manufacturers in this country are not generally inclined to invest large sums of money in experimental machines radically new, without any subsidy being paid by the government for that purpose.

Aircraft manufacturers in Europe are doing their best to develop new commercial types of aircraft in spite of the fact that they find themselves seriously handicapped by some features that they have to include in their designs in order to be able to collect from their governments those subsidies that they cannot afford to dispense with at the present time.

On the other hand, however, if the aerial operating companies in Europe had waited for the perfect commercial aircraft to make its appearance before starting operation, nobody at the present time would be flying from Paris to Casablanca and to Warsaw in twenty-four hours and from Paris to Constantinople in two and a half days.

If marine, automotive and railroad engineers had seeked the perfection before attempting operating engines that they knew quite well had to be further developed and perfected, we would have never had the steamship, the automobile and the railroad train, because the only way how to perfect a mechanism is to use it first as it is and see after what is needed to improve upon it.

In 1911 after the raid made by Paulhan d'Orleans at Arcis-sur-Aube somebody suggested to a well known high rank French officer who was in charge of aeronautical developments at the Ministry of War, that the time had come for organizing some military air squadrons, the answer was: "Wait, wait, do not run so fast with your imagination; the aeroplane is far as yet from heing in such a shape as to warrant its use in the army." And this happened only three years before the war started.

If we had waited for development of ballistics before building and using guns we would probably have now the same armament which was used by the Indians.

Thirty-five years were needed before reaching the present stage of development of the steam locomotive, twenty years were required to perfect the marine engine and fifteen years have been spent in perfecting the automobile. Do the critics of present day commercial aviation propose to wait twenty years before considering the aeroplane as a safe and efficient means of transportation?

Such critics are ready to concede that the aeroplane is an efficient war engine, but connot separate in their mind the military from the commercial arcraft. This is an error. The divorce of commercial aviation from military aviation is absolute, and it has been recently sanctioned in the note sent by the allies to Germany concerning the resumption of German commercial aeronautical activities which, it has heen decreed by the allies, must be based on the following conditions to be fulfilled by the German aircraft manufacturers: Ceiling 4,000 meters; speed at 2,000 meters altitude, 170 kilometers per hour; fuel for 3 hours flight; useful load 600 kg.

These conditions very nearly represent the average present state of affairs in commercial aviation and mark the heginning of the application of a sound economical regime for commercial aircraft.

Military aviation, on the other hand is progressing along an entirely different road: a pursuit aeroplane must be able to climb rapidly to 25,000 or 33,000 feet altitude and fly horizontally at 170 miles per hour; a bombing aeroplane must also be able to climb up to high altitudes with several tons of bombs on board and must be able to cover without stopping 500 miles or more.

At first sight the bombing aeroplane seems to be the best type which can be adapted to commercial exploitation. It is very often stated that the price of the ton-mile decreases with the increase of the load carried. These conclusions are arrived at through the mistake which is often made of comparing the aeroplane to a ship. A ship floats on the water without any need of motive power, while instead an aeroplane needs motive power in order to sustain itself in the air. Also the ratio between useful load and total load of a ship, for the same speed, increases with the dimensions of the ship whereby in an aeroplane this ratio remains practically constant.

An average attained by figuring on the characteristics of all sorts of aeroplanes, except scouting aeroplanes, shows that the load lifted by the present day flying machines is from 14 to 16 lbs. per h.p. or from 9 to 11 lbs. per square foot of lifting surface irrespective of the dimensions.

These are the fundamental basis which determine the separation of military and commercial aviation and it is an error to assume the interdependence existing between these two well defined and entirely separate phases of aerial navigation.

To talk about building commercial aircraft which in case of a national emergency can be efficiently adapted to military uses is a very optimistic talk. Of the 598 commercial aeroplanes now in use in France only a very small percentage could be used for military purposes and this fact is well recognized by French and other aeronautical experts.

We think that these facts should be stated and that it should be dispelled the delusion under which we are inclined to live that by developing commercial aeroplanes which repre-

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sent a compromise between commercial and military exploitation we are helping to build a powerful aerial defense at the same time that we provide for a fleet of efficient aerial commercial carriers.

The problems of military and commercial aeronautics are entirely separate the ones from the others and to put commercial aeronautics in this country under the control of military aeronautics as is the case in France, for instance, would be a mistake. What we need is a department of aeronautics, separate from both the Navy and the War Departments which will consider the problems of civil aviation from an entirely civilian standpoint.

But above everything else what we need now is to stop talking about commercial aviation and the limitation of present day commercial aeroplanes and start operating commercial lines with whatever commercial flying equipment we have at the present time. This is the only way that we can ever hope to develop aeroplanes well adapted to commercial uses.

Aircraft manufacturers who at the present time are living on government jobs will give to us the commercial aeroplanes that we need if we can show them that there is a field for such a production. We cannot expect aircraft manufacturers to design and build for us such aeroplanes without any subsidy on the part of the Government and without any organized commercial activities in this country.

Let us get busy, let us start doing something constructive for establishing civil aviation in the United States on sound business basis.

Remarkable Performance of the Loening Air Yacht

THE Loening Aeronautical Engineering Corporation delivered the air yacht ordered by Mr. Vincent Astor on schedule time, with no delays whatsoever, and the machine was flight tested by David H. McCulloch at Port Washington on June 19th and 20th, so that Mr. Astor, on his return from Europe on June 23rd, found his machine entirely ready for him.

He arrived on the Mauretania about eleven o'clock in the morning and after spending some time in the city, motored to Port Washington, and flew on his air yacht in about 50 minutes to New London, arriving there in ample time to see the Yale-Harvard boat races.

No other means of travel could have accomplished this result.

Several of Mr. Astor's guests took flights in the new machine after its arrival—a party of them returning to New York quite late the same night, arriving after dark.

Clifford Webster is pilot of the Astor Air Yacht and on June 26th flew up to Poughkeepsie with Mr. Astor and a party to attend the intercollegiate boat races there. The trip from New York to Poughkeepsie was made in about 50 minutes, and the return trip in about 40 minutes—most of the trips being made at a cruising speed in the neighborhood of 110 miles an hour.

The Astor Air Yacht differs only in detail from the original model of the Loening Air Yacht. The seating arrangement has been modified and a complete dual control system installed as Mr. Astor will fly the machine himself from time to time. The door to the cabin, formerly on the side, has been placed in the bow, and many detail arrangements, such as the anchor and other equipment, have heen greatly improved upon.

Special lockers for goggles, helmets, etc., have been provided.

Structurally the new flying boats are virtually the same, with the exception that the wings themselves have been increased in area, and in the interior of which all metal fittings have been doubled in thickness in order to give ample margin for the possibility of rusting.

The bottom of the hulls are made of an aluminum alloy, treated inside and out with a special marine glue preparation to prevent deterioration from salt water.

The new machines also have a larger gasoline capacity—Mr. Astor's air yacht carrying enough fuel to fly it non-stop for 500 miles.

The finish of the Astor machine is, of course, specially chosen by the owner. The color is a light grey, with dark grey finishing lines. The wings are treated with pigmented aluminum colored dope and the interior of the cabin is fitted with blue leather upholstery and light varnish woodwork finish.

The owner's private signal—a red star on a white field—flies at the mast, which also serves to hold the speed indicator tubes.

The instrument equipment is complete with compass, drift indicator, gas and oil pressure gauges, thermometers, tachometer, altimeter, air speed meter, etc.

The actual delivery of Mr. Astor's Air Yacht was of considerable interest, because the Loening plant, where this machine was constructed, is equipped with special Ogden type doors which, when raised up, form a clear opening 46 feet wide and 18 feet high. This is the largest opening in any building on Manhattan Island. It was thus possible, after the final assembly of Mr. Astor's machine in the factory, to wheel it out of the doors and on to the dock, where it was hoisted aboard a lighter and brought to Port Washington completely set up and ready for its initial flight tests. This is the first time that a fully set up aeroplane ready for flight has been brought out of a building in New York City.

There has been a great deal of flying lately on the Loening Air Yacht in this vicinity.

One of the most interesting experiences in this connection was had recently by Mr. Harold S. Vanderbilt, Commodore of the New York Yacht Club.

Mr. Vanderbilt has been flying with Mr. David H. McCulloch on the Loening Air Yacht ever since its return from Palm Beach and has made many trips, some as far as Marblehead, Mass. The following schedule, all done in one day, shows the remarkable ability of machines of this kind to cover long distances.

On Monday, June 26th, Mr. Vanderbilt played 18 holes of golf at the National Golf Links at Southampton, Long Island. He left there, accompanied by three friends, at about 12:30, with Harry Rogers piloting the Loening Air Yacht, and landed at 82nd street and the Hudson river in 52 minutes. This is a distance of approximately 95 miles, so that the average cruising speed was about 120 miles an hour.

The party lunched at the Columbia Yacht Club and then went to the Polo Grounds to attend the Yale-Harvard baseball game, leaving the Air Yacht anchored in the river. They stayed until the end of the game and then returned to the Columbia Yacht Club, where they again boarded the plane and proceeded to fly to Poughkeepsie to attend the 'varsity boat races, arriving there in time to see the entire race.

The party left Poughkeepsie about 7:15 and arrived at Port Washington, Long Island, about 45 minutes later, in time for dinner on Long Island.

Mr. Vanderbilt has ordered a Loening Air Yacht for his own use and this machine will be delivered to him about the middle of July and will be piloted hy Harry Rogers.

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A Challenge to the World

A CABLE dispatch to the Air Ministries of Great Britain, France, Italy, Spain, Portugal, Belgium, Norway, Sweden, Denmark, Cuba, Mexico, Brazil, Argentine Republic, Chile, Peru, Japan and China, over the signature of Rear Admiral Bradley A. Fiske, U. S. N. retired, challenged the aeronautical engineers and sportsmen of those powers to enter into a competition with a similar American group to circumnavigate the world with a commercial hydroaeroplane of one hundred passenger capacity.

This action disclosed the fact that a large group of American engineers have reached the conclusion that the era of commercial navigation on a big scale is at hand and that they have carried experimentation to a point where the design of the American entry for such a competition has been tacitly accepted. Details for financing and building the enormous flyer have been worked out and the group is prepared to put their scientific conclusions to a practical test by precipitating the international contest.

The challenge to Great Britain, of which those to the other countries are practically duplicate, follows:

"Please convey to representative group of British aeronautical engineers and sportsmen the compliments of American group affiliated in the project to build hydroaeroplane of hundred passenger capacity to circumnavigate the world for advancement of commercial aerial navigation. Stop. Also please convey friendly challenge to compete with British ship. Stop. Conditions of contest and details by mail upon receipt of assurances of entry.

The challenge followed the organization of the group as a trust estate under the name of "The American Eagle"—which has been adopted for the name of the airship when completed. Among the prominent engineers, aeronautical experts and scientists included in the group the following were mentioned yesterday by Secretary Cyril O. Assmus, in announcing the issuance of the challenges: Charles W. Burrows, Ph. D.; Charles H. Day, A. E. M.; Duval La Chapelle; Frederick Charavay, M. E.; I. S. Kaufman, B. S., C. E.; I. E. Glover, B. S.; J. H. Steenson; Joshua Ward, B. S., M. E., and Captain Hugo Sundstedt.

The latter has been named designing engineer of The American Eagle and his preliminary draft has received tacit acceptance. Captain Sundstedt's achievements in aeronautics have been international in scope. He left a naval career to take up aeronautics with Bleriot in 1909 and was later associated with Farman. During the war he was chief test pilot in the French Air Service. He holds honors for having made the first trans-Baltic Sea flight and Paris-Stockholm flight, among many others, and has been identified with American aeronautical activities since the close of the war.

Dr. Charles W. Burrows is a consulting engineer in New York with laboratories in Newark, N. J. He was formerly chief of the Magnetic section of the U. S. Bureau of Standards at Washington, in which post he served with professional distinction during the war, having been called to it from the department of physics at the University of Michigan. Dr. Burrows has accepted the post of Administrative Engineer and will pass on every detail of the construction and equipment of The American Eagle.

The board of consulting engineers

Airscape of the Stock Farm of Governor Warren McCray at Kentland, Indiana

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includes Charles H. Day, who, as chief engineer, designed the J-1 for the Standard Air Craft Corporation and built the American Handley-Page-Caproni bomber. He is engineer in charge of structure. Duval La Chapelle, who was with Orville Wright in France and is recognized as an authority on pontoons, which constitute his especial responsibility with the American Eagle. Frederick Charavay, M. E., among the foremost designers and experts on propellers is consulting engineer on this phase of the huge American plane.

F. A. Robertson, chief engineer of the Splitdorf Electric Company, and a recognized world authority on ignition, is in charge of electrical design and installation, and associated with the foregoing in charge of power plant, controls, material, instruments and aerodynamics, are engineers and experts whose names have not as yet been made public.

The partial personnel of the engineering staff given out by Mr. Assmus includes I. S. Kaufman, B. S., C. E., who has been active as a aeronautical engineer since 1910, and who served during 1918 and 1919 with the U. S. Army Engineering Corps, receiving a prize from the U. S. Government for designing a successful night bomber; I. E. Glover and James H. Steenson, who in addition to eleven years' experience in aeronautical engineering, devoted two years to exhibition flying and passenger piloting. Joshua Ward, B. S., M. E., was named as the Washington representative and Col. Evan Shelby as counsel.

Despite the naval and military tinge to the personnel, the American Eagle project and the competition it has invited are described as approached purely in the spirit of sportsmanship on the premise that the contest will blaze the way for larger scale aerial commercial activities of an essentially peaceful nature and hasten the adoption of aerial cruisers for trans-oceanic passenger, mail and express business. This aspect is emphasized by the past activities of Secretary Cyril O. Assmus, through whom the announcement was issued, and who has organized and directed many cruises for the British Royal Mail Steam Packet, and the Hamburg-American companies prior to the war. The latter said of the project:

"This undertaking is simply and obvious development of the day—an elaboration of what has been done and is being done on a smaller scale. Experimental 'stunt' and 'gypsy' flyers have paved the way so thoroughly that a large number of American aeronautical experts came to the conclusion that only concerted action was necessary to circumnavigate the globe with an airship of practical commercial size to settle once, and for all time, the question of the scientific mastery of the air for other than destructive purposes.

"Work on The American Eagle has progressed in a quiet way over a considerable time. Reports of similar efforts abroad reached our ears and after deliberation it was agreed that the most manly and sportsmanlike method of approaching the subject was in laying our cards on the table for all the world and to invite international competition. This will go far to clarify the status of various prizes that have been offered from time to time for this feat, and doubtless will result in the offering of other prizes and trophies by the sportsmen of the world. It will also serve to stimulate a friendly constructive interest and enthusiasm among those who realize the airship will supplant the ocean liner for first cabin passenger, mail and express business, as distinguished from those who see in the aeroplane only an agency of war and destruction.

"We feel that we have no accasion to fear that American ingenuity and constructive genius in this field cannot hold its own against the world. In this connection the names that have become public do not tell the story of the personnel group in this project. Every inventor, engineer or manufacturer who has anything of value to offer, may contribute his idea or feature without sacrifice of proprietary rights. It will be tested for efficiency and if of superior value, will be used, making the American Eagle a great American aeronautical laboratory or clinic.

"Negotiations are pending with many prominent men and organizations for whom we have no authority to speak at this time because the negotiations have not reached the stage of completion. Now it's up to the world to try to beat America in this field."

The Pegna-Rossi-Bastianelli Seaplane. The machine, which is of nearly 100 feet span, is intended to carry a very large proportion of disposable load at the high cruising speed of 100 m.p.h. It is equipped with four Isotta-Fraschini motors of 270 H.P. each, arranged two in tandem in each of the two wing nacelles.

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The Berliner Helicopter

HAVING perfected a helicopter which will rise gracefully from the ground and glide forward with the same precision as the most advanced type of aeroplane, Henry A. Berliner, a Washington inventor, is now busily engaged in further perfecting his vertical-rising airship so that it will alight with a degree of safety that will make it available for peace or war-time purpose.

The Berliner helicopter has undergone a series of tests at the flying field at College Park, Md., a suburb of Washington, before high aviation officers of the American Army and Navy and military attachés of foreign governments stationed here. All have pronounced the machine a success. In all the tests Berliner, the young inventor, has piloted the helicopter, which is capable of rising vertically from a standstill to a height of twenty feet and then advancing in a forward direction around the field without loss of distance from the ground. The machine, it is said, responded perfectly to Berliner's demands while in flight, but the inventor has not yet perfected the machine to the extent of landing from any height with the degree of safety that is required.

"We have demonstrated that our machine can rise vertically from the ground and we have further shown that it can move forward and is capable of control in flight," Mr. Berliner said today, "but the problem of landing safely is yet to be solved. Once this is solved I believe the helicopter will become as practical as the present-day aeroplanes, with the added feature of taking off in small areas and possibly landing in the same restricted zone."

Bringing New Machine to Earth Is Problem

Mr. Berliner would not discuss the possibility of entering his invention in the competition for the $250,000 prize offered by private British interests for the perfected helicopter. He said, however, that if he perfects his machine so that it will land with safety the future of the helicopter is assured.

Bringing the machine to earth safely, therefore, is the hig problem that Berliner has set out to solve. The machine as now designed comes down with a rock-like fall when the motor is cut off. With an engine of extreme nicety of adjustment and absolute certainty of action descent might be made by simply throttling down the propeller speed gradually. As there is no engine of such dependability, other means must be found by Berliner.

The use of parachutes or any balloon-like aid would add too much weight to the machine. Another method proposed is that in coming down the propellers he so built that they can be disconnected from the engine and the angle of the blades changed so that they will offer greater resistance.

The Berliner machine resembles an aeroplane without wings. The fuselage and rudder are the same, and a Lerhone 110-horsepower rotary motor is mounted forward as in an aeroplane. On either side of the fuselage there is an upright carrying a 14-foot propeller. These two propellers revolve in opposite directions and force the air downward, lifting the 1,400-pound machine and pilot off the ground.

Near the tail there is a small propeller, which is geared also to the motor and which tilts the entire helicopter by slightly lifting its tail. This tilt causes the forward motion of the machine. The inventor claims that with a 1,000-pound load but 3 per cent of the lift is lost in a tilt of 15 degrees, and that this loss is transferred into horizontal push of ahout 25 per cent of lifting power. This is a somewhat greater tilt than has been used in most of the experiments, hut he thinks that a 25-degree tilt may possibly be reached safely.

Idea Follows Plan Worked on by Father

In evolving the helicopter Berliner has heen preceded by his father, Emile Berliner, an inventor, who took up the old idea of constructing a machine that could rise vertically from a standstill about twelve years ago. Since then he had been experimenting, building and rebuilding it, until he was forced to give up the task about three years ago on account of illness. Henry, who is twenty-six years old and was graduated from the Massachusetts Institute of Technology, then took up the work and succeeded in making the first flight in a machine of that type.

The success of the machine is due, in part, the inventor said today, to the size of the two propellers that are placed on the machine in a position that would correspond to the outer wings of a biplane. Many have tried to use mammoth propellers, some as long as fifty feet, he said, but they derived no results.

The Berliner Helicopter in Flight

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Once in the air, the helicopter moves forward with the aid of a three-foot propeller attached to the tail of the machine, which tilts it downward.

The body or fuselage, which is about twenty feet long, was taken from an aeroplane, and likewise the rudder, which guides the machine from left to right. Both father and son believe the machine has wonderful potentialities. They point out that this type of aeroplane would be especially advantageous to the Navy, as the seaplanes and flying moats now in use require a long stretch of water as a "take-off."

The helicopter, or vertical-rising air machine, is not an impossibility, and should a real use for such type arise successful ones may be seen before many years, according to Dr. Albert F. Zahm, aeronautical expert for the Navy, in an interview with the Associated Press. Had there been a need for the helicopter during the war, he said, any of several types could have been perfected, of which working models have been flown.

Dr. Zahm is an expert on design and construction of all manner of flying machines. For years he has applied his time to perfection of the aeroplane, and is well qualified to pass upon the capabilities of any.

Much interest has been shown of late in reports of successful machines of the helicopter type being perfected in both Germany and England. However, while some flights have been made, none of any consequence are reportd by a machine equipped with horizontal propellers or revolving planes, designed to rise vertically from a confined space and descend on the same.

That the helicopter is possible, Dr. Zahm said, is proved by the German machine, which, rising several times to moderate heights, has carried observers, remained almost stationary while in air and descended in safety. The machine, however, has made no extended flight, such as would prove its dependability, but was tethered to the ground by a mooring rope. At times, when the motors failed, the machine dropped and the passengers saved themselves only by leaping with parachutes.

The experiments are continuing, however, with the purpose of perfecting a motor which can be depended upon to maintain the machine without sudden failure, the scientist explained, for as soon as the engine stops the machine cannot glide to the ground, as does an aeroplane, but drops vertically. In a proper descent the propellers should be whirled slowly to ease the landing.

Present hopes of attaining successful vertical flight rest mainly upon the endeavors of Mr. Berliner and of Louis Brennan, of London, whose newest machine is reported as nearing completion. He is working to win the £50,000 prize offered by the British Air Ministry for successful flight.

The helicopters upon which most experimentation has been made consist mainly of two or more propeller screws mounted horizontally on a vertical shaft, bearing engines, fuel and passengers. Equal numbers of propeller blades must revolve in opposite directions that the body of the machine may not spin like a top. The motors, tanks and body have been mounted in various positions, but the German machine has a sort of pulpit car mounted at the top of the shaft over the propellers for the operators.

Other Types of Vertical Flying Machines Offered

Whether or not this type of machine is brought to actual use, Dr. Zahm stated, at least two other types of planes that may fly vertically have been offered to the Government. This fact is not widely known.

One of these, of which Dr. Zahm observed experiments with a working model, was almost identical with the present type of plane, except that mounted behind the body were two sets of air vanes, in groups, tilted at an adjustable angle, like that of Venetian blinds.

When the power was turned on, he said, the "wash" of the air stream from the propellers pushing against these groups of vanes caused the model to rise gently vertically. The model was held in midair by the action, and when the power diminished it returned gently to earth. A full-size machine of the type, he said, would be equipped with engines of immense power in order to furnish sufficient air pressure, and when driven to a sufficient altitude the vanes would be so adjusted that horizontal motion would result. The plane could then fly in the usual manner, finally using the vanes again to descend vertically.

The other type offered to the Army, he said, was of the present wing plan, equipped with three propellers, two placed far out toward the wing ends and with vertical rudders and ailerons similar to those in use. The quicker lifting power was to he gained by having the wash of the central propeller act upon elevators on the tail of the body, while the side propellers would wash against the special ailerons on the wing tips.

When in the air, Dr. Zahm continued, this machine could maneuver exactly as does the ordinary plane, cut figures and do "stunts," besides being able to rest motionless in any desired position—vertical, with nose up, if need be.

The best feature, he said, is that both planes of the new types are entirely feasible and can be constructed at any time. In fact, several European inventors and manufacturers are patenting designs of the second type, notably the Frenchman Bleript, one of the pioneers of aviation.

Cost and Weight Called Drawbacks to Construction

Experts for the Government studied the second type during the war, it was explained, but the matter went no further.

The general drawbacks of their construction, Dr. Zahm said, were, first, the great cost; second, the increased weight of the machines as compared with present engine efficiency; and, third, the need of developing motors with greater power and less weight per horsepower and with a greater amount of dependability. As it is, he said, a successful helicopter may be flown to any height, but the operators will never know when the engine will give a cough and die away.

The German experimenters, however, he added, have in part overhalanced this disadvantage. It has been determined by experiment that a propeller of three or four narrow blades, caused to revolve by the air pressure resulting from a forced descent with a dead engine, will develop as much parachute resistance as a solid disc of the diameter of the blade spread. In addition, the German machine is equipped with air cushions on the landing bottom so that the landing, if forced, may be made comparatively easy.

Means of steering experimental helicopters, and of which one would undoubtedly be used in a successful machine, are two. The first is a means of tilting the propeller's shaft or the whole machine, when it will travel in that direction; the second being the use of vanes similar to those already described. With the latter, Dr. Zahm thinks, a helicopter sufficiently powered should be able to cut capers in the air as aviators do at present.

Any of the types advanced would, in warfare, be of great use in bomb dropping or for observation. The main disadvantage, that of being a good target for artillery fire while stationary, could be offset by quickness of movement from point to point and short stops while hovering.

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Detroit's Aerial Contests

THE Aviation Country Club of Detroit announces the sixth annual contest for the Curtiss Marine Flying trophy, first annual contest for the Detroit News Aerial Mail trophy, first annual contest for the Aviation Country Club of Detroit trophy, first annual contest for the Liberty Engine Builders' trophy, and the third annual contest for the Pulitzer trophy. This aviation meet was primarily scheduled for the purpose of holding the third annual Pulitzer Race. However, in order to arouse the widest possible interest in flying and stimulate the development of commercial aviation, the plans have been elaborated to include diversified types of planes. The intention is to attract a varied field of land and water entries to compete for prizes to be awarded on the basis of the best combination of high speed and improved construction without, however, having recourse to complicated rules incapable of being satisfactorily applied.

Event No. 1

The Detroit Aerial Water Derby, including Curtiss Marine Flying Trophy, Monday, September 4th. Cash Prizes: First prize, $1,200; second prize, $600; third prize, $200.

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the aero club represented by the pilot of the winning machine, and this club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine Trophy, or of assigning this privilege, under sanction, to any other club or organization.

The Curtiss Marine Trophy

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 6 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 70 miles per hour, as loaded for start of race.

(*c*) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to other contestants or spectators.

2. DISTANCE:

Approximately 160 miles — eight times around a closed course of 20 miles.

3. (*a*) START:

The starting signal will be given at 3 p. m. Planes to be in their allotted places at 2 p. m. Pilots' meeting for the final instructions to be announced later.

(*b*) POSITION AT START:

Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

(*c*) METHOD OF START:

Contestants will be lined up along the shore in shallow water for the start. The starter will assign an assistant starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 2:45 p. m. When the motor on each plane is running, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 3 p. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours.

4. THE FINISH:

The finishing time will be taken when each plane flies across the finishing line between the marks defining this line, after having completed the full course, 160 miles.

5. THE WINNER:

Of each first place shall be the pilot which has completed the full course in the shortest elapsed time, and of each second place the second best time, etc., provided the pilot is not disqualified. The Curtiss Marine Trophy will be awarded to the club represented by the pilot and the prize money paid to the entrant of the winning seaplane or flying boat. Agreements between pilots and entrants as to their proportional share of the prize money will be upheld by the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and entrants, presented to the Contest Committee prior to the race or within 24 hours after the finish of the race.

6. QUALIFICATIONS:

No seaplane or flying boat may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America. (F. A. I. Rules, Art. 67.) Every person furnished with pilot's certificate of F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America. (F. A. I. Rules, Art. 70.) A license will be valid until December 31st of the current year. The Contest Committee, Aero Club of America, may, upon the occasion of any competition or test, issue temporary license as pilot for this one test only to any person whose qualifications it considers sufficient. (F. A. I. Rules, Art. A-28.)

7. DISQUALIFICATIONS:

Any contestant breaking the above rules of the race, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

"Every person organizing or taking part in a sporting event of whatsoever nature is supposed: (1) "To know the present regulations (F. A. I. Rules) thoroughly." (2) "To agree to submit without restriction to the consequences that result therefrom." (F. A. I. Rules, Art. 7.)

8. RULES OF THE RACE:

(*a*) Upon receiving the getaway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

(*b*) From a standing start contestants will fly around the first four laps of the course, and during laps five, six and seven will be obliged to alight on the water and while running along the surface of the

The Pulitzer Trophy

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water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides.

Note: (There will be only one water control in the shape of a hairpin turn.) The entrance into and exit from this control will be located sufficiently near the turning mark that anything but normal landing speeds or normal taxing speeds will overrun the turning mark and result in loss of time.

(*c*) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons, or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water under this rule).

(*d*) A plane overtaken, both planes being in the air, must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

(*e*) A plane overtaking a slower plane, both planes being in the air, shall never pass or attempt to pass between that plane and any pylon or object used to mark a turning point.

(*f*) Within the water controls, both planes being on the water, the overtaking plane must pass to the right, and all mechanicians of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the left and result in loss of time.

(*g*) The finishing line must be crossed in flight—not on the water—and, after crossing the finishing line, all planes shall continue on their course until they have attained sufficient altitude to enable them to turn and land without crossing the course or finishing line.

(*h*) No contestant shall start before he receives the getaway signal.

(*i*) Pilots shall pass outside all turning points and in plain view of officials stationed at each point, and at an altitude of not more than 250 feet.

Fouling a Mark. "Any contestant who has failed to turn a stake properly may validly continue on the circuit provided he makes a complete turn of the said stake and then continues his trip in the same direction." (F. A. I. Rules, Art. 115.)

(*j*) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

9. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race. (F. A. I. Rules, 78, 79, 80.) (Appeals. See F. A. I. Rules, Art 178-179.)

10. NUMBERS:

Each plane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering over twelve inches in height.

11. ADVERTISEMENTS:

"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trade-mark of the constructor of the apparatus." (F. A. I. Rules, Art. 89.)

Note: (The word plane as used in these rules means flying boats or seaplanes.)

ADDITIONAL PRIZES:

The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time.

The first lap is not included because of the standing start.)

Additional prizes will be awarded for class or invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(*a*) CLASS RACES:

Four or more planes of the same design and equipped with the same motor shall constitute a class.

CLASS RULE:

Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

EXCEPTIONS:

Stream-lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions.

1. Stream-lining which does not alter the structure of the part or parts stream-lined.

2. Motors may be equipped with any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems.

(*b*) INVITATION RACES:

The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

Event No. 2

Detroit News Aerial Mail Trophy, Thursday, September 14. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for large-capacity, multi-motored aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 75 miles per hour.

(*c*) Carrying contracted, specified or advertised loads.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away, at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 11 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Detroit News Aerial Mail Trophy will be sent away together in a flight, or series of flights, dependent on the number of entrants and conditions at time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot, as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11 a. m., the starter will raise, in addition to the red starting flag; the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots must attain the altitude of the captive balloon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(*e*) All pylons marking turning points must be passed at an altitude not greater than 400 feet.

(*f*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the field, and land in that part of the field assigned for landing and in so doing shall not cross the course or finish line.

(*g*) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society within twenty-four hours after the finish of the race.

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9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of the lower wing on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

Event No. 3

Aviation Country Club of Detroit Trophy, Thursday, September 14. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for light commercial aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 80 miles per hour.

(*c*) Arranged to seat three or more passengers, including pilot, and carrying their capacity load; 160 lbs. of ballast must be carried in place of each passenger omitted.

2. DISTANCE:

Approximately 264 miles—four times around a closed course of approximately 66 miles, starting at Selfridge Field, passing over captive balloon located approximately 18 miles away at approximately 5,000 feet altitude, thence to Aviation Country Club's Field, thence to Packard Field, and then returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 12:00 noon. Aeroplanes to be on their allotted place on the Feld at 11:30 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Aviation Country Club of Detroit Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot as follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 11:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 12:00 noon, the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5:30 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, approximately 264 miles.

5. WINNER:

The winner of the first place in the race proper, shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots must attain the altitude of the captive ballon each lap, and in passing shall do so to either side in order that the observers in the basket may clearly see the aeroplane's number. Any pilot not having sufficient altitude upon reaching the balloon shall continue to climb, but must make a circle so that when passing the balloon the second time the aeroplane will be headed in the line of flight of the course.

(*e*) All pylons marking turning points must be passed at an altitude not greater than 500 feet.

(*f*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

(*g*) Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing on each side of the fuselage, clear of the wing in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

11. CONDITIONS OF TRIALS:

Trials for operation of self-starter and muffler for planes thus equipped—also the examination for bonuses given for complete accessibility to: Oil, water, gas-filling caps, draining plugs and filtering screens, ignition breakers and distributors, and carburetor adjustments and inspection —will be conducted from August 31st to September 13th, 1922.

12. Any contestant failing to make these trials during this period shall, at the discretion of the Contest Committee, forfeit the rights to the points which he may have gained—even though the trials are made after the race.

13. This trophy and cash prizes are to be awarded on points, given as follows:

(*a*) To the winner of the race proper—600 points. To those finishing within twenty minutes of the winner their pro rata share of points on the basis of a loss of 30 points per minute late.

(*b*) A bonus of 100 points will be given to each aeroplane carrying an operative self-starter.

(*c*) A bonus of 100 points will be given to each aeroplane carrying a muffler which effectively muffles the motor at a height of 1,500 feet, in normal flight.

(*d*) A bonus of 50 points will be given to each aeroplane having complete accessibility to the following: Oil, water, gas-filling caps and drain plugs.

(*e*) A bonus of 100 points will be given to each aeroplane having complete accessibility to the following: Spark plugs, oil and gasoline screens, ignition breakers and distributors, and carburetors in respect to both adjustment and inspection.

In the event of a tie in the scores of two aeroplanes, the aeroplane having received the greatest number of points in the race shall receive an extra point.

Event No. 4

Liberty Engine Builders' Trophy, Friday, September 15. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Race for observation type (2-passenger) aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor for safety—Monoplanes, 5 as loaded for start of race; biplanes, 4 as loaded for start of race.

(*b*) Air speed greater than 90 miles per hour.

(*c*) Carrying U. S. Government specified load for this type of aeroplane.

2. DISTANCE:

Approximately 240 miles—six times around a closed course of approximately 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and returning to Selfridge Field.

3. (*a*) START:

Starting signal will be given at 11:00 a. m. Aeroplanes to be on their allotted places on the Field at 10 a. m. Pilots' meeting for final instructions will be announced later.

(*b*) POSITION AT START:

Planes competing for the Liberty Engine Builders' Trophy will be sent away together in a flight, or series of flights, dependent upon the number of entrants and the conditions at the time of start. However, any entrant will be permitted to start alone after all flights if this request is made to the Contest Committee in writing before Sept. 9th, 1922.

(*c*) METHOD OF START:

The starter shall assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot at follows: The starting signal (for motors only), a red flag, will be raised by the chief starter at 10:45 a. m. When the motor of each plane is running the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11:00 a. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the bricks from under the wheels. Each

(*Concluded on page 424*)

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Annual Meeting of the Aeronautical Chamber of Commerce

THE annual meeting of the Aeronautical Chamber of Commerce of America, Inc., was held at the executive offices, 501 Fifth Avenue, New York City, July 11. The organization, which was formed the first of the year, with a charter membership of one hundred, reports an increase of nearly 100 per cent in six months. Preparations for flying meets in Chicago in August and Detroit in October were announced.

The following Governors were unanimously re-elected: Grover C. Loening, Loening Aeronautical Engineering Corp.; Charles F. Redden, Aeronautical Airways, Inc.; C. C. Witmer, Airship Manufacturing Co., of America; B. E. Bushnell, Stewart Hartshorn Co.; S. S. Bradley, Manufacturers Aircraft Association, Inc.; Charles H. Colvin, Pioneer Instrument Co.; S. M. Fairchild, Fairchild Aerial Camera Corp.; John M. Larsen, J. L. Aircraft Corp.; Lawrence Sperry, Lawrence Sperry Aircraft Corp.; Frank H. Russell, Curtiss Aeroplane & Motor Corp.; F. B. Rentschler, Wright Aeronautical Corp.

General Manager's Report

Following is the annual report made to the members of the Aeronautical Chamber of Commerce by the General Manager, S. S. Bradley.

Membership

Our organization was formally announced Jan. 1, last, with 100 charter members. In the first six months we have increased our membership to 176, divided as follows: Class A—19; Class B—39; Class C—117. Since the last meeting of the Board of Governors, 7 Class B and 13 Class C members have been added. In addition, full and complete co-operation has been obtained with two important groups in the lighter-than-air field. Among the new members are the following:

Electric Storage Battery Co., Philadelphia, Pa.

Endicott Forging & Mfg. Co., Endicott, N. Y.

Hamilton Aero Mfg. Co., Milwaukee, Wis.

Macwhyte Co., Kenosha, Wis.

Radio Corp. of America, New York.

Standard Oil Co. (Indiana), Chicago, Ill.

Tide Water Oil Sales Corp., New York.

Flying Meets

We have co-operated in holding two flying meets this spring; the first at Garden City on April 30, and the second at Baltimore on May 30. The attendance at the Garden City Meet was conservatively estimated at 20,000; the one at Baltimore, 5,000.

In addition to the above, we have an agreement with the Detroit Aviation Society contemplating our assistance in the management of the races at the flying meet to be given in Detroit next October.

General Contact

Washington: Close liaison has been maintained with official Washington. Representatives of the Chamber held a conference with President Harding on April 13, 1922, at which time the need of aerial law and an aggressive aerial policy was urged. Following this conference the President wrote a most important letter indicating the continuation and extent of his interest in the subject of aviation and our organization. A copy of his letter is attached hereto.

War and Navy Departments: Our contact with the Air Services has followed lines with which our members are familiar, and recently has been particularly active due to the participation of the Departments in the races at Detroit next fall.

For some time we have emphasized upon the War Department the necessity of great care in the release and sale of surplus material. In the past sales of surplus aeronautical material have resulted in a number of fatal accidents, due to the failure of machines in flight. We are therefore gratified to report that such a policy has now been adopted by the Department and that every precaution is being taken, in the absence of air law, to prevent unairworthy material being sold to the public.

We have consistently and persistently advocated recognition on the part of the public and the Government that we must have an aircraft industry before we can have aviation. We have recently seen many evidences of increased acceptance and appreciation of this fact.

During the month of May we completed and submitted to the War Department an extensive aeronautical industrial survey. This survey was based upon a questionnaire originating with the Secretary of War, which we addressed to our members. We have received various acknowledgments from officers in the Air Service and the Office of Secretary of War, advising us that the information thus gathered is greatly appreciated by the Department.

Post Office Department: On January 6, February 21, April 28 and 29, hearings were held by the House Committee on the Post Office and Post Roads on bills introduced by Representatives Steenerson and Kelly proposing authority for air mail contracts. At the request of the Post Office Committee, we sent out a questionnaire to our members and to 100 Chambers of Commerce throughout the United States. A digest of the replies was prepared and submitted by us at the hearings. All of which has been printed in the official report and distributed to our members. Through contact with the office of the Air Mail Division, we have advocated and encouraged the plan to develop night flying of the Air Mail.

Department of Commerce: We have prepared and submitted to the Secretary of Commerce a summary and report of commercial aviation in the United States during the past year. This was submitted to the Secretary of Commerce on April 10, and after being studied by the Department the report was released by Secretary Hoover to the newspapers on June 20. This report also provided material for distribution to Congressional Committees. It has also been very generally helpful as forming the basis for a very large number of constructive editorials in the newspapers throughout the country.

Aerial Legislation

Our work in connection with the Wadsworth Bill, S.3076, has been continuous. In addition to our interview with President Harding, we subsequently had conferences with the Assistant Secretary of Commerce, Mr. Huston; Chairman Winslow of the House Committee on Interstate and Foreign Commerce; Dr. Klein, the head of the Department of Foreign and Domestic Commerce; and Judge Lamb, Solicitor of the Department of Commerce. At Judge Lamb's request we called, at very short notice, a conference of our members at our offices in New York. At this time the entire subject was discussed in detail and it was planned that following this conference final recommendations from the Department of Commerce were to be prepared and submitted to Congress. The advancement of the bill is now delayed on account of a suggestion that has been made to give consideration at this time to the question of the desirability of consolidating all aeronautical activities of the Government in a single department. This is regarded as very unfortunate as it will delay final consideration very greatly.

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Trade Association Conferences

On April 13 we participated in the National Trade Association Conferences with Secretary Hoover. A representative of our office was appointed to serve with the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers' Association, to prepare a foreign trade booklet, to be distributed by the Department of Commerce throughout the world. Copies of this pamphlet have been sent to our members.

On May 16 to 18 we attended meetings of the Chamber of Commerce of the United States. As members of this body, our activities fall within the Department of Transportation and Communication. The manager of this department, J. R. Bibbins, is assisting us in establishing contact with the various local Chambers of Commerce throughout the United States for the purpose of enabling us more effectively to extend our educational work.

We are finding increasing opportunities to extend our work and establish close contact with local commercial organizations throughout the country. Due to the interest aroused by us in the Air Mail hearings, the Merchants' Association of New York City sent a representative to attend the hearings in Washington. Following this, which coincided with a request for data from the Chief of the Air Service, the Merchants' Association decided to appoint an Aeronautical Committee. We had the privilege of conferring with them relative to the personnel of this group. As a result, a member of our organization has been requested by Lewis E. Pierson (president of the Irving National Bank), president of the Merchants' Association, to act as a member of this committee, with a number of very prominent and influential business men whom they have selected for this service.

We have maintained very close relations with the Chambers of Commerce of Boston and Philadelphia. At Philadelphia a representative of our office addressed the representatives of their organization and obtained places on the Aviation Committee for two of our members who are in business in Philadelphia. In Boston we have co-operated with the Chamher of Commerce in their successful effort to secure through the State Legislature an appropriation providing for the establishment of a municipal airport in that city. A letter from this organization, thanking us for our support and co-operation, expresses the conviction that our activity had a very great deal to do with the successful outcome of this movement. We have participated in similar propositions with Chambers of Commerce of Baltimore, with the Aero Club of Illinois, the Chicago Association of Commerce, and other organizations in Burlington, Vt.; Brunswick, Me.; Kansas City, Mo., and Hartford, Conn. A representative of the Chamber addressed the Aero Club of Hartford on this subject of municipal landing fields a few weeks ago.

Except for those members who are in frequent contact with our office, there is probably very insufficient appreciation of the extent to which our offices are used as a meeting place for the exchange of ideas and discussion of general questions affecting the art and industry. There is a constant flow of visitors, the facilities of the library are in constant and increasing demand, questions affecting individual members and the industry as a whole are submitted to us for consideration and advice, with the result that the organization acts as a stabilizing and at the same time stimulating agency, with a constant tendency toward straight thinking and harmonious co-operation throughout the entire field. While this places a great tax upon the personnel of the office, making it at times very difficult to handle the correspondence and other details of routine, we feel that it is very essential that this work be maintained. One tangible result of. this sort of contact that must be apparent is in the quality of the publicity that we are getting. Without the advantages of a clearing house, such as our offices afford, there would be a vast amount of misinformation released and printed. The amount of this sort of material, based upon rumor or suspicion, or hope or expectation, that is arrested and diverted each week is very considerable.

Publicity

Our activities in this field have been carried on along the lines with which members are all familiar. In some respects the work has been expanded. On our initiative arrangements were made for the broadcasting of aeronautical information from the great radio station on Staten Island. This was made possible through the courtesy of the Radio Editor of the New York *Tribune*, Jack Binns. Within the last few weeks we have supplied thirty magazine writers with material and photographs for aeronautical stories. Motion pictures of aeronautical events, which we have either arranged directly or have assisted, are running each week. Aeronautical photographs have been given to the news photo agencies two or three times a week, and at frequent intervals stories of current aeronautical interest are supplied to the Associated Press, the International News, the United Press and all foreign news syndicates with headquarters in New York.

We frequently learn, some time after the event, that various members have participated or had knowledge of important aeronautical news stories, where the opportunity has been missed of utilizing our facilities in securing proper publicity, due to failure to notify us of the event at the time. The members are particularly requested, whenever practicable, to report to this office promptly any event in aviation that appeals to them as being desirable publicity. We cannot promise that each story reported will be featured, but you may be certain that, to the best of our ability and judgment, the matter will receive prompt attention.

Year Book

The Year Book is now ready for distribution. Members are requested to order Year Books promptly if they have not already done so. This year's edition will be particularly valuable due to the Engine Division in the Design Section. This consists of 18 full pages of line drawings of historical and contemporary engines.

Bulletin Service

Every effort is being made by the Chamber to eliminate waste motion, to establish economies and yet maintain our service. The sales, library, Congressional and other memoranda you are familiar with. To meet a real demand, especially from the Class C members, and also to provide a medium for the dissemination of data of general interest to all members, a new series of bulletins has been established to be known as "Information." This bulletin, the first of which was issued in June, will be produced the first of each month and sent to the entire membership. This is also used for publicity purposes.

New Projects

Detroit Races: We have an agreement with the Detroit Aviation Society to co-operate with them in the management of the races at the time of the contest for the Pulitzer Trophy in October of this year. A representative of our office will attend to the details of management of the races beginning July 20 and ending October 20, and this office will, either from New York or Detroit, handle and direct all publicity.

Chicago Meet: Through the incorporation, a few weeks ago, of the Chicago Aeronautical Bureau, the situation in Chicago crystallized into

(*Concluded on page* 412)

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The 18-Ton Parseval Semi-Rigid Airship "PL27"

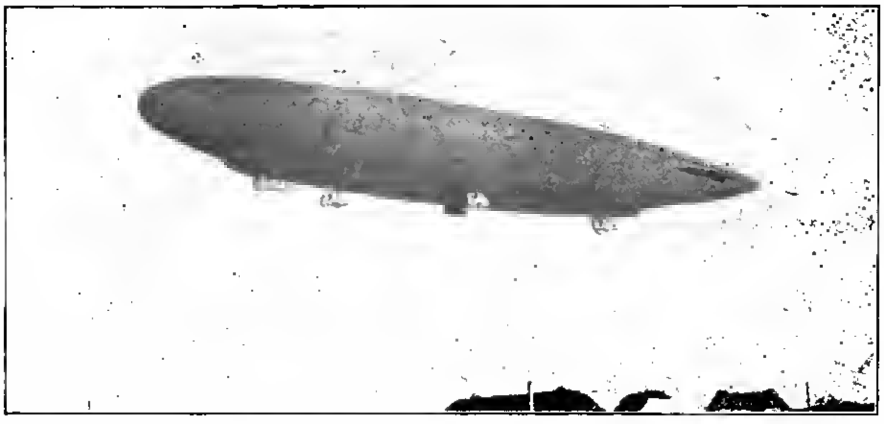
ALTHOUGH built as long ago as 1916, there are several reasons why the Parseval type "PL27," designed and built by the Luftfahrzeug-Gesellschaft of Bitterfeld, is of sufficient interest to merit a fairly detailed description at the present time. In the first place, the airship was one of the largest semi-rigids ever built, being only very slightly smaller than the ill-fated "Roma," purchased by America from Italy some time ago. Secondly, her design was one representing a considerable departure from previous German non-rigid practice, approaching, in fact, more to the Italian than to previous German types. In spite of the accident to the "Roma," this type of airship is thought by many to have a very considerable future before it, and it is open to discussion whether the world, led by Germany, was right in deciding in favor of the rigid type of ship. In Germany at the present time, there is a strong opinion that the limits in non-rigid and semi-rigid airships have in no way been reached, and certainly one could enumerate several advantages which these types possess as against the rigid. One very important item is that of cost, and in this respect the non-rigid, and, to a somewhat smaller extent perhaps, the semi-rigid compares very favorably indeed with the rigid. The very expensive Duralumin framework is avoided, which at once means a great saving. Col. Cave-Browne-Cave, one of our soundest, and certainly our most persistent and eloquent advocate of the non-rigid airship, stated in one of his admirable lectures before the Royal Aeronautical Society that, according to his calculations, six non-rigids, each of 500,000 cubic feet capacity, could be built for the price of one rigid of 2,000,000 cubic feet capacity. In other words, with the non-rigid, we should get an extra million cubic feet capacity for the same money.

Then there is the question of useful load. Here again Col. Cave-Browne-Cave indicated that a greater percentage of useful lift is obtained in the non-rigid than in the rigid, owing chiefly to the absence of the hull structure. Thus the point where the structure weight is no more than 50 per cent of the total lift is reached in the non-rigid with the half-million cubic feet ship, whereas in the rigid it is not attained until one comes to sizes of about two million cubic feet. It would, therefore, appear that we may have been on the wrong track in pinning our faith almost exclusively to the rigid type. With things as they are at present, the question of the purchase, running and upkeep of a rigid is a big item. It is, at least, open to doubt whether we should not be better advised in making a start on airship services with types other than the rigid. As regards safety, there is probably little to choose between the types, and the non-rigid, apart from the advantages already outlined, has another in that, when not in use, it can be deflated and stored away in the corner of a shed. A rigid airship occupies as much space when deflated as it does when inflated. Furthermore, in the case of a forced landing, the non-rigid, and the semi-rigid which has its keel built in sections, can be packed up and sent home. The rigid, if it should be forced down from any cause, would almost certainly have to be written off as a total loss.

There is a great deal more which could be said about non-rigid and semi-rigid airships in general, but sufficient has, we think, been said to indicate that, as it has now been proved that these types need not be restricted to small airships, this class of airship deserves more consideration, from a commercial aviation point of view, than it has received in the past.

The Parseval "PL27" has an over-all length of 157 meters (515 ft.), a maximum diameter of 19.6 meters (64 ft. 4 ins.), a greatest circumference of 61.55 meters (202 ft.) and a height of 26.5 meters (87 ft.). Its cubic capacity is 31,300 cubic meters (1,104,000 cubic ft.) and the disposable lift is approximately 18,000 kilograms (nearly 18 tons). Assuming a lift of 65 lbs. 1,000 cubic ft. of hydrogen, the total lift would be approximately 32 tons, so that the disposable lift is 56 per cent of the gross lift, which is considerably better than the figure of 50 per cent given by Col. Cave-Browne-Cave for a 500,000 cubic ft. ship. The allocation of this 18 tons of lift would, of course, depend upon the purpose for which the airship was intended. For a very long flight a great proportion of it would be taken up by the fuel. For shorter distances the lift which could be set aside for paying load would increase. If the route on which such a ship was used were to be divided into stages of approximately 1,000 miles each, the "PL27" could carry a crew of seven, sufficient fuel to leave a safe margin, and, in addition, have accommodation for about twenty-five passengers. It will thus be seen that, as regards earning capacity, the "PL27" should be a very useful craft as a passenger and mail ship, especially as her cruising speed is said to be about 60 m.p.h. It is estimated that these airships could be built in England for not more than £30,000 each, and if built in batches, the cost should be even lower. Thus, by reducing the length of the stages flown to approximately 1,000 miles, a much more economical service should be possible than if large rigids, capable of doing the London-Cairo trip without landing, were employed. In this way, the time for the journey to Australia, for instance, would be somewhat increased, but, on the other hand, it is at least conceivable that a greater revenue would be forthcoming, as it should be easier to fill up the ships with passengers for shorter distances over portions of the route.

As regards the design and construction of the Parseval "PL27," this ship is, to some extent, based upon the Italian designs in which there is a keel structure running the greater part of the length of the airship, and to which are attached some of the heavier local loads such as petrol and water tanks, central engine



The 18-Ton Parseval Semi-Rigid Airship "PL27"

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View of the forward position of the airship, showing the control car

cars, etc. This structure is so designed that its parts form, as it were, the links of a chain. In the "PL27" the keel, which is about 330 ft. long, is divided into fifty-two separate cells or units, the whole being so designed that the keel can resist longitudinal loads, but not bending moments, owing to the manner of joining the cells to each other. The keel is built up of a tubular framework consisting of four main longitudinals, struts and wire bracing.

Three of the cars, the control car and the front and rear engine cars, are attached direct to the keel, while the two side engine cars are slung by cables from the envelope, and steadied laterally by struts to the keel. The attachment of the keel to the envelope is by rigging wires and fabric. As already mentioned, the keel serves to support, in addition to the three cars, the petrol tanks and water ballast bags.

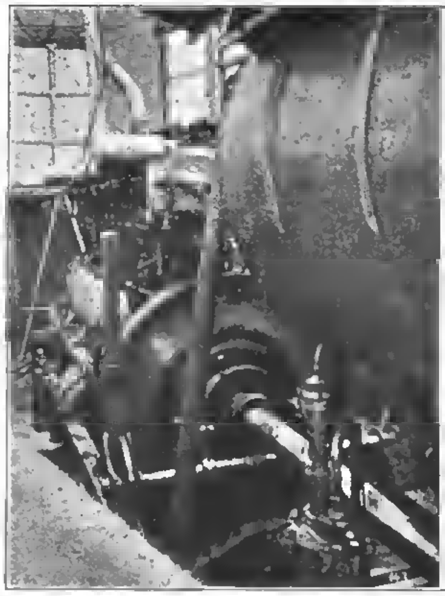
The latter are of two kinds. One is known as "trouser" (*Hosen*) bags, and are emptied singly by means of a ripping line from the control car. The other kind has valves, and is emptied, also from the control car, two at a time. All the bags are of 200 kilogs. (440 lbs.) capacity. The "trouser" bags are mounted four forward and two aft. The ordinary bags, of which there are thirty-six, are distributed along the keel, the valves of every two bags being connected to one control line, so that with these 880 lbs. of water is discharged at a time. The total amount of water ballast carried is thus 8,400 kilogs. (18,500 lbs.).

The petrol tanks are hung in the keel, as shown in one of the accompanying photographs. Normally, thirty petrol tanks are carried, twenty-six main tanks and four gravity tanks, one for each engine. The capacity of each tank is 200 kilogs. (440 lbs.), so that normally the total petrol capacity is 13,200 lbs. (nearly 2,000 gals.). Provision is, however, made for slinging another ten petrol tanks in the keel, bringing the petrol capacity up to 8,000 kilogs. (17,600 lbs., or about 2,500 gals.) if long journeys are contemplated. The list available for paying load is then, of course, correspondingly decreased. In fact, by the time one had counted in a crew of about ten, with their provisions, there would be little more load available.

As regards the placing of the petrol tanks in the keel, they are arranged in three groups, corresponding to the arrangement of the engine cars. The forward group, feeding the front engine, consists of six main tanks and one gravity tank. A similar number and arrangement feed the aft car, while the central group, which supplies the two wing engines, consists of fourteen main and two gravity tanks. All the tanks are arranged for easy slipping in case of emergency.

The arrangement of the cars will be understood from a reference to the accompanying photograph of the airship in flight. The control car is placed right forward. A short distance aft of this is the forward engine car, under the keel of the airship. Approximately half-way along the length of the ship are the two wing engine cars, some distance out from the center line, and finally near the rear end of the keel is the aft engine car. Each of the engine cars contains one 240 h.p. Maybach engine, driving pusher screws through reduction gearing and clutches. The engines are mounted with their crankshafts about 10 ins. above the floor of the car, and the lower part of the crank-case can be reached by removing a loose floor plate. The transmission includes a reverse, two wheels being in mesh for forward and three for reverse. The reduction is such that, although the engines run at 1,400 r.p.m. at full power, the propellers run at 180 r.p.m. only. Their diameter is 14 ft. 9 ins. A blower, or fan, placed in the stern of the car, is driven at a speed of 1,850 r.p.m., by means of a silent chain, and delivers 2½ cubic meters (88 cubic ft.) of air per sec., at 100 mm. of water. The engine cars have a length of 6 meters (19 ft. 8 ins.), a maximum width of 1.8 meters (5 ft. 11 ins.), and a height of 1.6 meters (5 ft. 3 ins.).

The control car is 9 meters (29 ft. 6 ins.) long, 2 meters wide (6 ft. 7 ins.), and 2 meters high. It is divided into three compartments, of which the forward one is the control cabin, and the aft one the wireless compartment. From the central compartment access to the keel is gained via an automatically closing trap door, and a shaft leads through the hull to a platform on the top of the envelope. In the control cabin the rudder control wheel is placed forward and slightly over towards the starboard side. The elevator control



Views inside the port engine car. On the left, the engine, clutch, and air compressor; on the right, close-up view of the engine and blower

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wheel is placed on the port side. The control cabin is, of course, provided with a number of instruments, as well as with the controls for gas and air valves, etc.

The hull or envelope of the "PL-27" is made of three-ply fabric, of which the inner and outer layers run longitudinally, while the middle layer is placed at an angle of 45 degrees. The tearing strength of the fabric is stated to be 2,000 kilogs. (4,499 lbs.) per meter width. In addition to this strong fabric, the hull is strengthened by so-called trajectory bands. These are bands of webbing, about 2 ins. wide, stuck to the envelope fabric and covered with water-tight cover strips. The use of these bands constitutes, we believe, a Luftfahrzeug-Gesellschaft Patent. The tearing strength of these bands is 1,320 lbs.

The gas space is divided by three fabric bulkheads, into four compartments, of which the forward and aft have a capacity of 6,260 cubic meters (220,500 cubic ft.) each, while the other two have a capacity of 9,390 cubic meters (331,500 cubic ft.) each. The fabric bulkheads are reinforced with wehhing and are capable of carrying a difference in pressure between their two sides. If, for any reason, it should be necessary to equalize the pressure in two adjoining gas compartments, this can be accomplished by a hose which is normally kept closed by being tied up, but which can be opened by the crew.

Each gas compartment is provided with an air bag or ballonet, which when completely filled occupies 52 per cent. of the gas compartment volume. Thus, the capacity of the fore and aft ballonets is 3,250 cubic metres (115,000 cubic ft.) each, and that of the second and third ballonets 5,000 cuhic metres (176,500 cubic ft.) The ballonets consist of two portions, the lower of which, attached to the envelope, is made from two-ply fabric, of a tearing strength of 1,200 kilogs. per metre width, while the upper part is in a single thickness and has a strength of 900 kilogs. (2,000 lbs.) per metre width.

Each of the gas compartments is provided with two gas valves, placed in shafts and discharging through the top of the envelope. The openings on the top of the envelope are covered with fabric hoods. Each ballonet has two air valves, built into the keel, and having discharge pipes leading into the open. In addition, each ballonet has an inlet valve of the flap type, serving to admit air from the fans. The four flap valves communicate with a common pipe or hose, into which all four blowers discharge. Each hallonet has also a pressure regulator (automatic) which ensures that there is always an excess of pressure of 25 mm. of water. Should the pressure fall to 23 mm., the regulator opens the inlet valve, which communicates with the common pipe from the blowers and keeps it open until the old pressure has been established, when the valve is closed. If the pressure rises to 27 mm., the pressure regulator opens either the air valves of the ballonet or the gas valves of the gas compartment, or both, according to the setting of the switches in the control car. The actual operation of pulling the air or gas valve cords is carried out by the automatic regulator, although when required, as, for instance, in landing, members of the crew can operate the valves direct, without the action of the regulator.

Two views of the port engine car. On the right can be seen the struts which brace the car to the keel structure

The tail planes are so attached by struts, etc., that they cannot be pressed into the envelope. They are designed for interchangeability, the fins and tail planes being identical. The elevators are, however, different in shape and size from the rudders.

Altogether, the Parseval "PL27" is a very interesting airship, and it has proved that it is possible to design even quite a large ship without necessitating a change over to rigid construction. It is confidently expected by the *Luftfahrzeug-Gesellschaft* that, if desired, even larger ships can be built on this principle, hut even taking the "PL27" as she existed in 1916, the type should have a considerable sphere of nsefulness at the present time, and the type has the advantage of having been tried out to the satisfaction of the designers, behaving well during maneuvering, and showing a good turn of speed. It may be expected that when Germany is once more free to develop, without the present restrictions, more will be heard of airships of this type, and we should not be surprised to hear of regular services heing established hetween Berlin and London, which cities are sufficiently far apart to afford a considerable saving in time by traveling by air, and yet not so far as to necessitate the use of rigid airships.

Reserve Officers Receive Instruction at Mitchel Field

Twelve reserve officers reported at Mitchel Field, L. I., New York, in a body on Saturday, May 13th, for flying and for instruction in installation of radio equipment on aeroplanes. Major Harrison H. C. Richards, Air Service, on duty with the Reserve, was in charge of the party. All of these officers were given flights, which took up largely refresher flying instruction and practice landings. To date, no reserve officer who reported at this station with proper credentials, authorizing participation in aerial flights, has been refused an aeroplane.

The Army pilots charged with the duty of giving this refresher instruction to the many reserve officers reporting at Mitchel Field report that these officers get hack into shape very rapidly.

The Air Service Mechanics' School

At the present time there are 550 students undergoing the various courses of instruction at the Air Service Mechanics' School at Chanute Field, Rantoul, Ill. This leaves an approximate number of 110 men awaiting instruction. These men will be entered within six weeks. The entrance of this number of men will exhaust the last of the men enlisted in the recruiting drive some six months ago. There are now sixteen courses of instruction in active operation.

Photographic Missions Completed

Lieutenants Robert E. Selff and Wm. C. Goldsborough, have completed their seven thousand mile photographic mission, having photographed all available landing fields in Northern California and Nevada. They landed at Crissy Field while the Flying Circus was in full blast, and were heartily greeted hy their flying "Buddies".

On Friday, May 26th, Captains W. A. Bevan and R. G. Irwin and Lieutenants J. P. Richter and C. R. Weber landed at Crissey Field, after completing their mission of photographing the landing fields of Southern California and Nevada. An 18,000 ft. high sandstorm was encountered hy them on their flight across Death Valley, which, it is believed, is the reason for the copper tipping on their propellers being so shiny.

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The Handasyde Type H.2 Monoplane

THE FUSELAGE

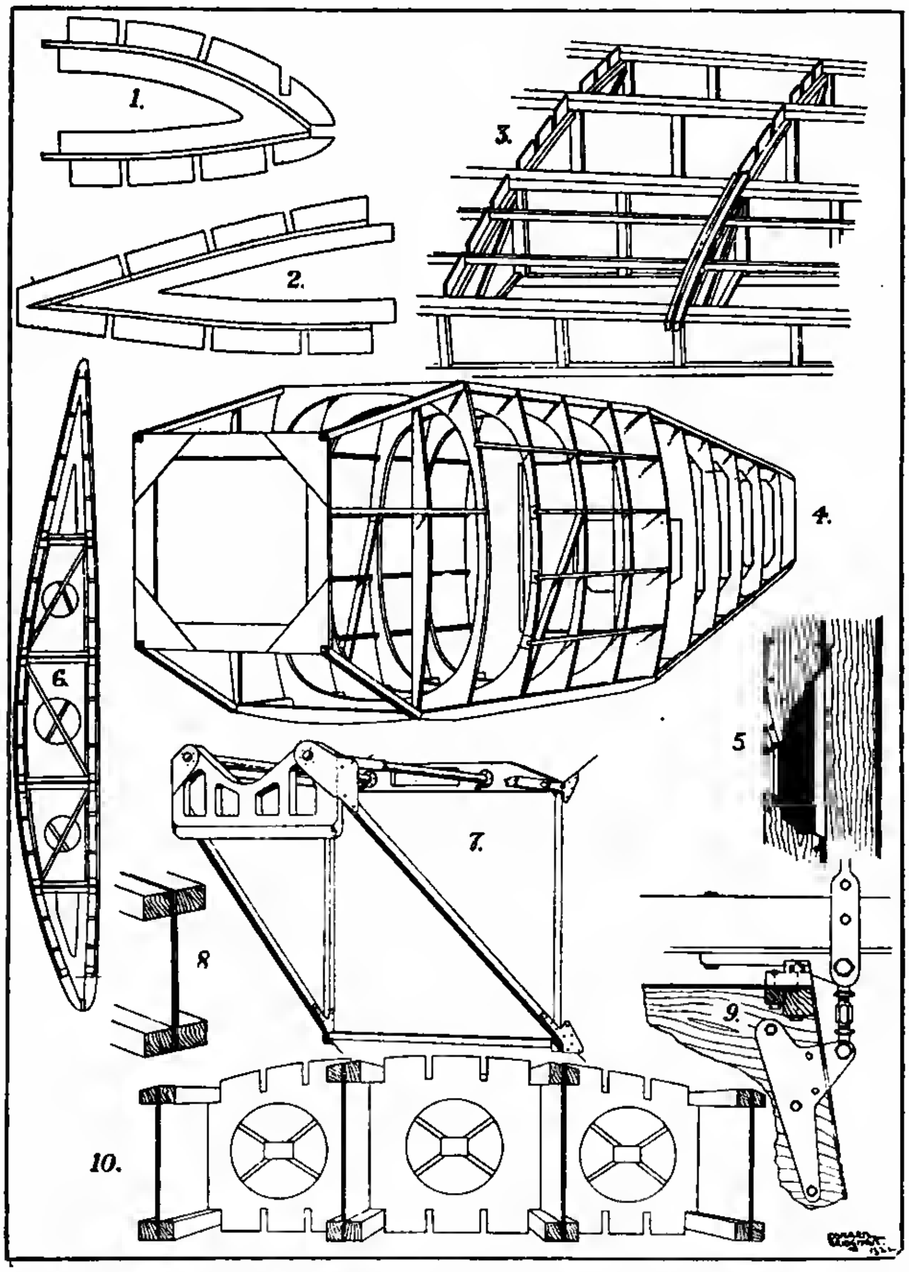
The fuselage—which is apparently the least novel part of the machine—appears to be of the normal three-ply covered type now so widely in use. Actually it has a number of novel features, and is not quite so commonplace as it might at first appear. It is really of the braced longeron and strut type, the bracing being performed by the ply wood skin. The "struts" are in the form of hoops, which also act as formers.

This fuselage is built in two parts, the forward one an engine-carrying nose, and the after part, which contains cabin, etc., and carries the tail. The main fuselage body is built on four longerons—each one of which is in three straight lengths. The forward length, of spruce, covers the space occupied by the pilot's cockpit. Over this space the longerons diverge rapidly in side elevation from front to rear. There follows a second straight length, corresponding to the passenger cabin, which is also of spruce. Over this space the four longerons are parallel. From the rear of the cabin to the tail longerons are of ash. The top longerons over this section slope down very slightly towards the tail, the lower longerons sweep up very considerably.

Joints between these longeron sections are of the simple fishplate type, and are covered by three-ply skin—so that the main body of the fuselage is not a dismountable structure.

The front frame of the forward section consists of four spruce members, with three-ply cornerpieces. There is an intermediate set of four spruce struts and thereafter follows the hoop structure of the cabin.

The hoops—which are in effect the fuselage struts, in this cabin portion—are of box section. The inner member of each box is a bent hoop made of ash in two plies. The outer members are of spruce, and the sides of the box are formed by three-ply. The whole structures are glued and screwed together.



Details of the Handasyde Monoplane.—(1) the nose and (2) the tail of one rib former. (3) Part of the main wing structure, showing the four main spars and two ribs. The left band rib is without capping strips. The through stringers are in place between the two nearest spars, and the capping strips are in place over the first section of the rigbt-hand rib. (4) The skeleton of a fuselage seen from the front. (5) Section of one of the fuselage main hoops, showing construction. (6) Elevation of a complete rib (compare figs. 1, 2, 3, 4). (7) The nose of the fuselage. (6) Diagram of wing spar structure. (9) Attachment of a wing spar to the fuselage. (10) End view of a wing root, showing spars and four sections of the formers for a rib

The after "hoop" at the cabin end has the three-ply sides of the box extended inwards, and a door-frame worked into the structure, thus partitioning the cabin from a mail compartment which is immediately aft of it.

Aft of the cabin, the struts are built up of spruce only, but are in general of the same type of shape as the cabin hoops. The first beyond the cabin is three-ply covered to form the bulkhead of the goods space, but is fitted with a sliding door so that one may crawl into the after part of the fuselage for inspection. At the rear end of the body there is another solid bulkhead just forward of the front spar of the tail plane.

Over and above the four main longerons there are numerous stringers of spruce from the front of the cabin to the tail. In the cabin length these stringers are continuous, except for the necessary stoppage at the door, which is arranged between the first two of the cabin frames. They are let into the outer spruce members of the hoops. Over the after part these stringers are stopped at each frame, and serve only to support the outer skin. The skin of three-ply is screwed to all frames, longerons, and stringers. Joints in the three-ploy are made by butting the two sheets, applying a "fishplate" of three-ply about 4 inches wide on the inside only, and riveting through from skin to "fishplate" with hollow rivets of about 3/16 diameter pitched about 3 inches apart.

The general appearance of a fuselage framework uncovered is shown in one sketch. A succeeding sketch shows the engine-carrying nose which is attached to the main body. This nose consists of two ash members on each side, which meet at a forward cross member of five-ply spruce. The engine bearer tubes run from the front cross member to the upper cross member of the bulkhead in front of the pilot. This nose does not form a

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detachable engine mounting, because the after support for the engine bearer is part of the main fuselage structure. The nose is however removable after taking out engine and bearers, and this appreciably simplifies packing up the machine for transport.

WING STRUCTURE

The structure of the wings is the most interesting part of this machine. The machine is of the cantilever monoplane type, with the wing entirely above the fuselage. The whole conception of these wings is unusual. They are of the multi-spar type, with a wooden covering, and apart from the joints between the wings and the body, the two halves of the wings, and aileron hinges and control mechanism the only metal parts employed are screws.

The wings are heavily tapered, both in plan and in section, from root to tip. The leading edge sweeps back slightly, the trailing-edge very pronouncedly. The section is an unusual one. The top surface is of the usual type, with its maximum camber in the region of 1/3 the chord from the leading edge. The lower surface is practically flat over the spars, but slopes down sharply from the leading edge to the front spar, and somewhat less sharply up from the rear spar to the trailing edge. The section therefore is biconvex. The four spars, which are spaced at approximately equal intervals across the chord, are all of the H section built up, with top and bottom flanges of spruce in two halves, and a web of spruce two-ply, which web is covered with glued on fabric. The flanges are glued and screwed to the webs.

The ribs are formed of three-ply built in sections which fit into the recesses in the spars. They are stiffened with spruce members glued and screwed to them, roughly parallel to the wing surfaces, but considerably inside those surfaces. The outer edges of these rib webs are notched between spars, the through-going spruce longerons are run through the notches. There are two of these stringers between each spar. Over the stringers is applied a set of continuous spruce laths, which form the rib flanges proper. These are screwed to each spar and stringer. The covering consists of strips of spruce, corrugated internally, which are laid on parallel to and flush with the rib flanges, and are also screwed to each stringer and spar. This spruce skin serves the purpose of drag bracing, and also as the top and bottom flanges of the composite girder formed by the whole structure. The leading edge and the trailing edge are formed by three-ply formers similar to those between spars, which are supported by the through rib flanges. These are also provided with longitudinal stringers running right through. The leading edge proper is formed of three-ply bent to trough section, screwed to the leading stringers, which are of extra heavy section. The trailing edge is of solid spruce.

The details of this very novel wing structure are well shown in some of the accompanying sketches.

The wings are built in two sections, which join on the centre line of the machine. Owing to the fact that except in the case of the front spar, all spars meet at an angle, it has required form of joint. A sketch shows how some ingenuity to obtain a simple the difficulty has been overcome.

The wings rest on the top rail of the fuselage over the cabin. An aluminum block is fitted beneath each spar, and this block carries at its outer end a downward projection which registers on the outside of a mating block of the same material on the longeron. This block on the longeron is fitted with two upwardly projecting tongues, one of which registers on each side of the block on the spars. Therefore when each set of these blocks is properly engaged, the wing is accurately located both laterally and longitudinally in reference to the fuselage.

The lift load from the spar is taken to the main fuselage structure through one right- and left-hand screw adjuster—generally of the nature of the ordinary wire strainer, which is coupled at the top to a strap surrounding the spar and at its bottom to a lug attached to one of the main fuselage frames.

From this description and from the sketches it will be realized that this machine has many features of great novelty and interest. The type of construction is necessarily somewhat expensive at the outset, but as soon as the necessary jigs are set up repetition should be extremely cheap. The absence of complicated metal fittings allows the machine to be built by any competent staff of woodworkers, and if in fact the type proves to be free from trouble due to warping of the timber, it may prove to be a serious rival to metal structures in the future.

The Aeraplane.

A New Czecho-Slovak Commercial Biplane

IN the first commercial aeroplane to be designed and constructed in Czecho-Slovakia this re-born country has demonstrated that, in spite of the fact that up to a few years ago its aviation industry was conspicuous for its absence, it is already capable of taking its place amongst the foremost aircraft constructing nations. This new commercial machine has just been turned out from the works of the Aero Aircraft Factory of Prague, whose designers, MM. Husnik and Vlasák, are to be congratulated in having produced a machine the general lines of which at once strike one as being both practical and pleasing to the eye.

The Limousine Ae 10 was designed to meet the needs of the growing demand for aerial intercourse with neighboring countries, the Republic being determined to take an active part in the various aerial services running, and to be run, to and from Czecho-Slovakia. It is a tractor biplane, with a deep *fuselage* of good streamline form. The engine, a 260 h.p. Mayhach Mb. IVa, is mounted in the nose and drives a 10 ft. 3 in. tractor screw. The radiator is mounted behind the latter, and has been found to give very satisfactory results, causing little resistance.

Behind the engine is an enclosed cabin accommodating three or five passengers, and separated from the engine compartment by a double metal-covered partition as a precaution against fire. The cabin is very roomy, well upholstered, and has double walls, ceiling and flooring, giving an exceedingly strong construction; it is also isolated and noise-proof, and so adds to the safety and comfort of the passengers. Three windows, glazed with Triplex, on each side of the cabin give a good range of vision, whilst the rear window may be used as a direct communication between the cabin and the pilot—conversationally, of course.

Access to the cabin is by means of a door on the right-hand side of the cabin. In the cabin are three comfortable seats, and two tables which are upholstered underneath, so that they can be tilted up and used as seats when two extra passengers are carried. At the rear of the cabin is a space for luggage, measuring 5 ft. 10 in. by 3 ft. by 2 ft. Above this is the pilot's cockpit, just behind the main planes, from which an excellent view in all directions is obtained. Provision is also made for the accommodation of a navigator, who has a seat just behind the pilot, and both can easily change places if desired. A fire extinguisher, in direct communication with the engine and carburetor, is also located in this cockpit.

The main planes are in five sections, the lower in two attached direct to the *fuselage,* and two upper attached to a small center section. They are set at a dihedral angle, but no sweep-back, and the top plane has a very

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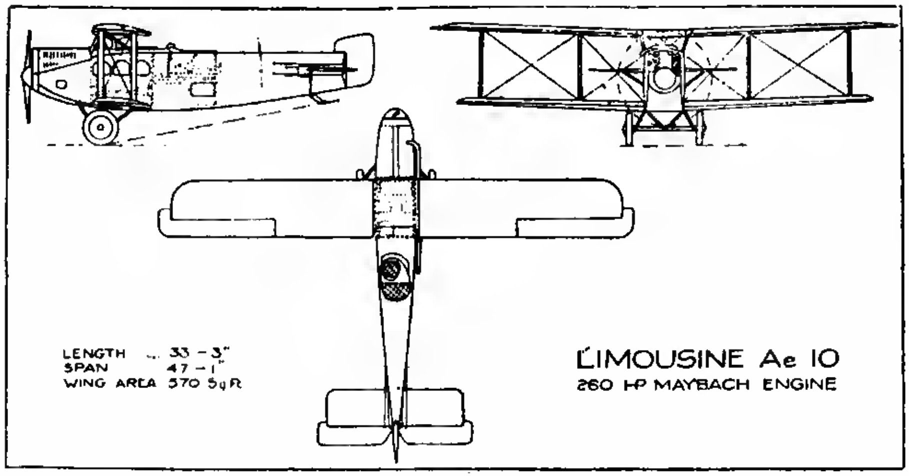

slight overhang. Balanced *ailerons* are fitted to the top plane only. The main petrol tank is carried in the top center section, whence the petrol is led by gravity through a single pipe, *via* a filter, direct to the carhuretor. The petrol system is thus of the simplest form possible. The tank is filled hy means of a special pump, and the petrol passes through a filter before entering the tank.

The tail planes are of tubular steel construction, fabric covered, and consist of an adjustable rectangular horizontal stabilizer, mounted between the upper and lower *longerons* just above the line of thrust, two balanced elevators hinged to the stabilizer, and a balanced rudder. No vertical fin is fitted, as the flat sides of the *fuselage*, which tapers to a deep vertical knife-edge, renders this unnecessary. The controls are of the conventional type —elevator and *aileron* column, and rudder har.

Special attention has been given to the undercarriage, as it was realized that many of the accidents are caused by faulty landing gear. The two wheels are of large diameter—960 mm.—with the object of enabling the machine to land on very soft and uneven ground. They are located well forward, which has the effect of giving a quick pull up. The wheels are mounted on a divided axle, with rubber shock absorbers, which is carried by twelve steel struts, having six points of attachment to the *fuselage*. These struts are arranged in three pairs of "M's, when viewed from the front, as indicated in the accompanying general arrangement drawings. Landing shocks are thus well distributed over the *fuselage;* in places the factor of safety is about 12, both in the landing chassis and cabin. Throughout the machine double wiring is employed.

The principal characteristics of the Limousine Ae-10 are:

Span	47 ft. 1 in.
Chord	5 ft. 9 in.
Length	33 ft. 3 in.
Height	11 ft. 8 in.
Area of main planes	570 sq. ft.
Useful load (3 pass.)	1,650 lbs.
Weight, fully laden	1,620 lbs.
Weight/sq. ft.	8.2 lbs.
Weight/h.p.	17.7 lbs.
Speed	93 m.h.p.
Duration	4 hours
Engine	260 h.p. Rayhach

—*Flight.*

Weather Forecasts

In its desire to have its forecasts, warnings, and information made of the greatest possible benefit to aviation and aviation interests, the United States Weather Bureau has arranged a plan of cooperation with the Chief of Air Service, U. S. Army, by which it is hoped closer contact may be established between its aviators and Weather Bureau officials in the field.

The plans of this cooperation have been announced by the Chief of Air Service to all commanding officers of Air Service fields in a letter which describes the arrangement.

In this letter the Weather Bureau requests that, in order that the personnel of the Army Air Service and the Weather Bureau may become personally acquainted and by so doing be able to discuss the possibilities and limitations of their respective services, the pilots at the various Air Service fields in their regular training fly to the various Weather Bureau stations shown on the Weather Bureau map which are within a radius of 300 miles from such fields, become acquainted with the personnel at such stations, discuss the problems of the two services, and arrange a system of cooperation. The prevailing weather conditions of the particular section of the country involved should be discussed as bearing upon the work of the Air Service. On these trips the pilots should make notes of the terrain flown over and the landing facilities en route and at the destination.

The Weather Bureau deems it advisable that lectures on the general work of that Bureau, the weather conditions of the particular country where Air Service fields are located, and meteorological subjects pertinent to aviation should be delivered to the Air Service personnel, and the Chief of the Weather Bureau invites applications from Air Service Fields with the purpose in view of making arrangements for the delivery of such lectures.

Aviation forecasts for the six aviation forecast zones of the United States covering the country east of the Mississippi River are broadcasted by Radio from the Naval Radio Station at Arlington at 10:30 a. m. (5950 CW) and at 10:00 p. m. (2650 CW). The Weather Bureau requests that arrangements be made to have radio operators on duty at Air Service stations within these zones receive these forecasts. The night forecast will cover weather conditions in the zone until noon of the following day, whereas the morning forecast will cover weather conditions from noon until midnight.

The Washington *Post* and the Washington *Herald* publish each morning a special forecast furnished them by the Weather Bureau for routes from Washington, D. C., to Norfolk, Va., and from Washington, D. C., to New York City, and arrangements will soon be made for a similar forecast for the route from Washington, D. C. to Dayton, Ohio.

Request for information on weather conditions from Air Service fields, whether made by telegraph or telephone, are to be without expense to the Weather Bureau; but any aviator of the Army who has made a landing at a point not near an Air Service field is permitted to send a prepaid telegram to a Weather Bureau office for the purpose of obtaining the latest forecasts and information as to prevailing or conditions. Weather Bureau officials receiving such messages are instructed to reply promptly, giving the best possible information in answer thereto and transfer same to the sender at the expense of the Weather Bureau, such reply messages to be checked "Paid WEA."

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AERIAL AGE

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Shall Britannia Rule the Air?

A PROGRAM of development of aviation which would give to Great Britain as complete a domination of the air as was her domination of the sea prior to the world war is now under consideration and apparently likely of adoption as a definite permanent policy of the British government. Dispatches from London report that the British press is flooded with aviation propaganda preparing the people for huge government expenditures necessary to float an air fleet, subsidize private commercial lines, aid plane and motor manufacturers, continue experimentation, and train and maintain pilots, observers, and mechanicians.

That is a natural development of the British character and of Britain's many years of experience in the government of an empire stretching around the world. The British government and people have long realized that only through the maintenance of the world's greatest navy could they have full assurance that the lines of communication and trade between the widely separated parts of the empire would be kept open and maintained in any emergency. A dominant navy meant life of the empire.

The rapid rise of the United States as a sea power in the closing years of the world war brought Britain face to face with the necessity of sacrificing this position. The American program threatened to outbuild Britain. The economic condition of Britain was such that it could hardly hope to compete. At the same time lessons of the war and experiments in the sinking of battleships by aeroplanes which followed the war cast considerable doubt upon the ultimate value of battleships as opposed to aeroplanes. There was no certain conclusion that a $40,000,000 battleship would be helpless before a $10,000 aeroplane, but there was a doubt.

The odds were too great to bet against. That, probably as much as anything, was a leading factor in the Washington decision for the limitation of capital ships. But that did not change the British belief in the necessity of remaining dominant among the nations if possible. The great aviation program outlined is a direct result of that conviction. It shows the way for America.

Our dominions extend from the Philippines to the Virgin islands, and from Alaska to Porto Rico. Our responsibilities extend even further—definitely to the tip of South America. We must be in a position to defend and maintain this territory and these responsibilities. If England has, through its envoys, accepted the 5-5-3 naval agreement only with the intention of stopping development on the sea to begin it in the air, our program should be clear before us.

Every British aeroplane should be matched by an American aeroplane. Every British dirigible should be matched by an American dirigible. Every British hangar and landing field and supply station and experimental station should be matched by its equivalent in American territory. Every British expert in the development or operation of flying machines and in aerial warfare or commerce should be matched by an American as good, or better. And then we should have a few extra.

We do not expert to have war with Britain. In fact we intend not to have war. But in any emergency which may arise we should be competent to emerge the victor. We have voluntarily given up what would have been a campaign of superiority on the sea. Thereby we have saved hundreds of million of dollars without additional risk. But that risk comes if we submit to a position of inferiority in the air. No premium is too great to pay for insurance against such a risk.—*Editorial in Chicago Tribune.*

Army Air Service Promotion

THE death during the flight of two officers of the Army air service—those of Captain Thomas H. Shea, Jr., and Lieutenant R. E. O'Hanly—has again called attention to a situation in that branch that is in dire need of correction. Such casualties are of so frequent occurrence as to sustain a record of eight per cent of flying officers who are killed every year. Vacancies created in this way are not filled by the promotion of air service officers, but by transfers to the air service of officers of other branches of the Army. The air service is unfortunate in the position on the promotion list of its junior officers, who, because of their long period of training during the war, now find themselves segregated near the bottom of the single list. Their seniors are in many cases younger in age and only longer in service by a few weeks or months, a circumstance that determines relative place on the promotion list, by virtue of the fact that the average period of training in other arms was about three months as compared with the air service training period of about nine months. The result has been that not only has the commissioning of air service officers been delayed, hut, whereas officers of other arms had an opportunity for being initially commissioned in grades as high as field officers, the air service officers were limited to being commissioned in the grade of second lieutenant, with few exceptions. Furthermore, there was lack of promotion in the air service during the war, because it was a new corps. When the single list was compiled after the appointments of July 1, 1920, it was found that practically all of the officers, who were originally commissioned in the air service as flying officers, held tbe bottom files of the promotion list. That left vacancies in the grades of captain particularly, and these were filled, and are being filled, by officers transferred from other arms, who have had no war experience in air service activities and who are in many instances junior in age. The air service has a total of 900 officers, of whom over 700 are officers commissioned subsequent to April 6, 1920, and of this 700 about 500 are original flyers whose commissions were delayed, so that 200 of them are officers who were transferred from other arms or who came in as ground officers and are ranking the junior officers of the air service. The latest returns of the adjutant general's office show 608 first lieutenants in the air service, while in the infantry, which should have approximately three times as many as the air service, there are hut 1,008. The reason for this is that the majority of young officers in other arms, instead of heing first lieutenants, are captains.

The situation in the air service in respect to promotion has heen the subject of consideration hy the special

(*Concluded on page 426*)

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THE NEWS of THE MONTH

Navy Gets $6,537,000 to Build New Aircraft

Washington.—Inclusion of a Senate amendment of $6.537,000 in the naval appropriation bill for new construction of aircraft was agreed to June 21 by House and Senate conferees on the annual supply measure. It was the first meeting of the conference.

While the committees were discussing the appropriation measure Senator Pomerene (Dem., Ohio) announced in the Senate he had been informed that Admiral Wilson, Superintendent of the Naval Academy, had notified thirty civilian instructors there that their services were to be dispensed with.

The appropriation hill, as it passed the Senate, carried a provision for reducing the number of civilian instructors from the present 118 to 80 and Mr. Pomerene condemned the reported action of Admiral Wilson as presaging further attempt to get rid of the civilian instructors.

New York Flyers Forming Own Unit

New York is to have a flying unit all its own. There has been at Hempstead a temporary aviation squadron, but these men were part of the 102d Infantry, and when the unit is recruited will be transferred back to the 14th Infantry. Recruiting for the unit, which will be known as the 27th Air Service, has been started and a group of New York men who brought down many enemy aviators during the war have signed.

Among these are Major Kenneth Littauer, who was a member of the Lafayette Escadrille; Capt. G. De Forest Larner, who brought down eight enemy aeroplanes; Capt. Curtis Wheeler, who has six citations; Capt. George A. Vaughan, Jr., who has a record of thirteen enemy machines, the D. S. C. and British, French and Belgian medals; First Lieut. Howard Burdick, who brought down eight enemy planes, and nine other officers who did valiant service in Europe.

General Order No. 16, sent out from the State Adjutant General's office, authorizes the reorganization of the air service for the State Guard. It orders change of station to Miller Field, New Dorp, Staten Island, and allocates the seaplane hangar in the southeast corner of the 300 acres as the armory for the 27th.

Capt. G. L. Usher, U. S. A., is designated as the Regular Army air instructor for the National Guard. Capt. Usher already is in residence at Miller Field. The total strength will be 31 officers and 160 men, including a photograph staff of twenty and five intelligence men.

Tarkio, Mo., Flying Meet

The merchants and business men of Tarkio, Mo., are promoting an aero meet at Tarkio, July 27-8-9, inviting all flyers to compete in events, paying all expenses, such as gas, oil, hotel expenses and entertainment, and giving many cash prizes and cups and trophies. C. E. Tuttle is employed to manage the meet.

Tarkio is the home of Tarkio College, a town of about 3,000 population and very much alive.

The field selected for the meet is an 80-acre blue grass field one and a half miles south of town, with plenty of emergency fields adjoining.

The Larsen Trophy

The Contest Committee of the Aero Club of America on June 30th directed C. B. Wrightsman, of Tulsa, Oklahoma, to return to the Aero Club of Omaha, $3,000 in prize money, which it is alleged, was wrongfully awarded to him following the Larsen efficiency aeroplane contest, held in Omaha last November. This step, it was learned, is the first in the adjustment of a situation which has been the subject of discussion in American aeronautics for many months. John M. Larsen, donor of the trophy, whose entries in the race established undisputed performance, notwithstanding which the officials made the award to Wrightsman, has presented evidence supporting his claim that a fraud was perpetrated. Wrightsman is ordered to return the money within 10 days or be disqualified. Upon return of the prize money, further hearings will be held.

Spokane News

Captain Lowell Smith, one of the army air service's best known pilots and holder of several American air records, landed in Spokane at the municipal field at Parkwater on June 22 in a 400-horsepower De Haviland-Liberty motored plane. He is accompanied by Sergeant Whitefield.

Captain Smith is flying over the west, mapping all municipal and other landing fields for use of the government army flyers. He made the best time in the transcontinental air race two years ago, fighting a close contest with Captain Belvin Maynard, the "flying parson."

On his present trip out of headquarters at San Francisco, Captain Smith and his sergeant have photographed landing fields in California, Wyoming, Nevada, Utah, Boise, Montana and are now completing their map-making work in Washington.

They left next morning for the Coast, stopping en route to take field photos at Walla Walla, Yakima, Pasco, and other central Washington points.

He has covered 6000 miles since leaving California. Captain Smith and Sergeant Whitefield have been assigned to the photographic work by the air service.

The Bellanca Model C. F. Monoplane which made an excellent showing at the Monmouth Flying Meet

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On an aerial tour from Buffalo, N. Y., to Siberia, C. O. Prest, aviator, landed in Spokane on June 21. He is making what he claims is the first transcontinental aerial travelogue moving picture ever taken and expects to cover over 8500 miles on his trip.

Prest carries a moving picture camera especially mounted so he can use it while operating the plane, and two ordinary cameras for still pictures. He took several hundred feet of film of scenes along the Spokane river in Spokane.

Aviator Prest has been flying since 1910, having flown first in the old Bleriot monoplane and the old-time Curtiss machines. A month ago he started on his cross-country trip. Before coming to Spokane he took aerial views in and around Glacier park.

La Porte Carnival

The Cleveland Air Transit Company is planning to hold an air carnival at La Porte, Indiana, on August 15 and 16.

Cincinnati News

Cincinnati will have no municipal airport for at least another year, is the announcement made today by C. W. Culkins, executive secretary of the Cincinnati Chamber of Commerce, due to the fact that the Government will not establish a reserve squadron station here and contribute the greater part of the finances. Mr. Culkins made the announcement after a statement to this effect had been received from Senator Frank B. Willis.

Regardless of the fact that there is no field at Cincinnati available for landing, the Cincinnati Aircraft Company is making rapid progress, and during the past week has made several sales, using a field near Harrison, Ohio, for its facilities. A small factory has been established at Second and Sycamore streets, where rebuilding and repair work is being carried on on a small scale. It is understood that this company will secure the services of Mr. D. W. Huntington, aeronautical engineer of Hempstead, N. Y., with a view to building a transportation ship. Negotiations are being carried on between the officers of the company and Mr. Huntington to this end, it was stated by Secretary M. H. Held, of the company.

Mr. H. F. Woolard has been appointed representative of the Cincinnati Aircraft Company for Indiana, with headquarters at Indianapolis.

New Aerological Survey Issued by Weather Bureau

Of special value to aviators is a section dealing with free-air winds, contained in a discussion of free-air conditions of pressure, temperature, humidity, density, and wind, as observed by means of kites, issued as Supplement No. 20 of the Monthly Weather Review by the Weather Bureau, United States Department of Agriculture.

The winds have been classified according to wind direction at the surface, and the average amount and frequency of veering and backing with altitude, increase in speed, percentage frequency of each direction, of north and west components, and of speeds above 10 and 20 meters per second have been determined and are presented in tabular and graphic form.

Many tables and figures are given in the supplement, and also a series of charts valuable to meteorological students. The marked difference between summer and winter conditions in the free air. as at the surface, though in less degree in the former is well brought out in these charts. It is a significant fact that the average direction and rate of movement of storms across the country are very nearly the same as the average wind direction and speed at heights of 3 to 5 kilometers. Measurements have been taken by kites up to 5 kilometers, or 3 miles.

This publication, which is available to interested persons upon application to the Weather Bureau, is Part I of an aerological survey, which will later include the diurnal variation at different heights, the results of observations with pilot balloons, and similar information.

Kansas City Activities

Plans for an airdrome which will make Kansas City a leader in aeronautical activities were announced on June 18, by the Flying Club. A 53 acre field, which will be leased to the government and operated under supervision of air service officers is being purchased by Major Howard F. Wehrle, Rogers Crittenden, Frederick H. Harvey, Robert E. Lester and Simpson Yeomans.

The site which has been approved by Major Ira A. Rader, of Fort Crook, Neb., corps area air officer, and Capt. St. Clair Street, a member of the National Airways board, is on the Davenport road a few hundred feet south of Blue Ridge boulevard on the way to Rayton.

Plans for the development of the field are tentative, include:

Eight hangars, arranged about the rectangular field, two garages, and a machine ship, motor car parking space, a grand stand with a capacity planned at five thousand, space for a clubhouse for the flying club, space for an aviation school, where civilian fliers may be trained. This would be a privately owned concession.

Quarters for the civilian flying school, barracks and similar enterprises, and a field marker in the center of the field with "K. C." lettered in colors on a white background.

The field will be used by the government and civilian aircraft. It will be used by the government for army operations and training purposes. Principally for the training of reserve officers. Also the air mail will be accomodated at this field in addition to the establishment of the national guard aviation squadrons at this place.

Boston is the only city which has taken advantage of the government plan of leasing privately purchased ground for an airdrome, so far. Other cities which have similar plans are San Francisco, Chicago, New York, Los Angeles and Minneapolis, it is reported.

Major Wehrle who was active in securing the field, is particularly well equipped to direct successfully a project of this kind.

Pilot Chas. Pedley and Mrs. Pedley, who are doing good work in the Southwest and West

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He superintended the laying out of Hazelhurst field, Mineola, New York, the first government school in the East and the second in the United States. He was one of the early aviators who took training with the Curtiss company in 1916. When the war broke out, he was a Captain in the air service, and was immediately assigned to the task of preparing plans suitable for aviation fields. His plans were copied by various fields about the country.

According to the plans of the five men, an Air Terminal association will be establisbed and incorporated with $40,000. Stock will be sold, and facilities on the field will be provided for by the corporation. Five hundred square feet of ground on the terminal field will be let to the flying cluh for the building of a clubhouse. In addition the club will carry on their activities on this field free of rent or charge. The old American Legion field at Sixty-seventh street and Belinder road will be abandoned as soon as the lease expires on November 1, 1922. A new hangar there which is nearing completion will be moved to the new field, according to plans of the flying club. Also all other facilities will be transferred to the new field or other points. There are now twelve ships on the present field, all actively engaged in flying. Much of the flying is done in passenger carrying and training of pilots.

Following the announcement of the plans for the terminal, Mayor Frank Cromwell voiced approval of the new enterprise and urged the early developments, that Kansas City might get ahead as rapidly as possible.

"It is not only a matter for those who are directly interested in flying to think about," the Mayor said, "but it is a civic matter and will be a distinct asset to Kansas City."

At present the final details and purchase of the field depends on Washington. As soon as the lease is signed by the government, work on the hangars and the field will commence. It is said that the new airdrome will be completed by the first of the coming year.

The Air Service plans to send ten planes and a detachment of six men, one officer and five enlisted men, who will supervise activities.

At a meeting of the flying club in the hotel Baltimore, June 22, evening, after three hours' debate, the club decided to indorse the project and accept the plans of the terminal association. At first much opposition to the plan was voiced by Francis Poindexter and a committee of four men. They argued that should the club accept the proposal of the association, Kansas City's aerial activities would fall entirely into the hands of five men, that the club would lose its prestige and would no longer be the city's leading faction in the promotion of flying.

Several squadrons of reserve officers of the air service are established in the vicinity of Kansas City and with these organizations eager for active participation in flying along with civilian flying much activity is apparent for Kansas City. Two manufacturing concerns are considering branch factories here in addition to three air lines which are proposed from Kansas City to Chicago, from Kansas City to Oklahoma City and from Kansas City to St. Louis. The main sales office of the Huff Deland aero corporation is established here, and plans are on foot to move the factory from Ogdensburg, N. Y. to Kansas City. Also the Longren Aircraft of Topeka, and the Laird Swallow company of Wichita are now preparing plans for active work in Kansas City. The Laird Swallow company is establishing a regularly operated air line between Kansas City and Wichita which will be in operation as soon as two large planes for the purpose are completed.

Petitions for the establishment of an air mail terminal are also under advisement. The association hopes to bring this service through Kansas City before the year expires. Two new flying schools are in preparation, and in addition to passenger work, much of Kansas City's advertising in the nearbly states is carried on by aeroplane. The Victor Oil company here have two planes which are used to carry their salesmen about the country.

Spokane News

Co-operation of local aircraft companies, centralization of activities and a comparatively small amount of money spent on the Parkwater municipal field will give Spokane aviation facilities second to none, Captain Lowell H. Smith, famous army flyer, said while in Spokane recently.

In his big De Haviland plane, driven by a 400-horsepower motor, he left Spokane, circled the field, the city and Fort George Wright, while taking aerial photographs, and then soared away to the west, headed for Yakima.

In the interests of the Army air service Captain Smith and his aide are making a 6,000-mile trip over the West, mapping the principal landing fields. He will take back pictures of 75 fields when he reaches headquarters at the Presidio, near San Francisco.

"Parkwater Field is the best I have seen since leaving Cheyenne, Wyo., which is on the Government aerial mail route," Captain Smith said. "It is large enough for a four-way field and one of the best in the country. The city or somebody should devise some means of clearing parts of the field of rocks which now dot the surface and which might cause someone to damage a ship.

The Dirigible Mooring Tower at Lakehurst, New Jersey

"Your aerial activity at Spokane should be centralized. All flyers here should co-operate to make the business a success and should all put their ships at the one field. With all flying from one field, there would always be someone ready to go into the air and far better results would be obtained."

Captain Smith says Spokane has one of the few fields in the West suitable for teaching beginners flying work. Its size, he said, affords beginners far greater safety.

The Commercial Club at Walla Walla, Wash., obtained an indefinite lease on a tract of land one mile east of the city for use as an aviation field. The land is owned by Eugene Tausick and the Baker Langdon Company and can be leveled at little cost. The owners agreed to let the club use the land without cost. Several automobile dealers have agreed to furnish tractors to help level the ground. This is the first step in a movement to put Walla Walla on the aerial route. The field will be available to any aviator who happens to be traveling through and will be suitahly marked so that it can be plainly seen from the air.

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Air Mail Performance

At 12 o'clock Sunday night, July 16, the Air Mail Service of the Post Office Department completed a year's daily service without a single fatal accident. During this time the planes flying on the New York to San Francisco route covered 1,750,000 miles. More than 49,000,000 letters, totaling 1,224,500 pounds, were transported.

The record of the Air Mail Service for the past year proves more conclusively than any other test ever made the reliability and the efficiency of the aeroplane in commercial service. Through every kind of weather, summer, fall, winter and spring, and over mountains, deserts and forests, the Post Office Department air mail planes flew. The percentage of trips actually completed was 92.5 per cent, as compared with 83 per cent for the last fiscal year. The percentage of scheduled miles actually flown was even higher, totaling 94 per cent.

While routes totaling 820 miles were discontinued during the last fiscal year and only the transcontinental route of 2,680 miles maintained, the Air Mail Service nevertheless carried the same amount of mail as it did last year, or 23 per cent more in each aeroplane load.

Officials of the Air Mail Service attribute the record of no fatal accidents in a year to the fact that all their pilots now are experienced and tried and they know the route. That the pilots of the Air Mail planes of the Post Office Department are top-notch among the flyers of the United States was established at a recent Midwestern flying meet at Monmouth, Ill. Here the flyers of the Air Mail Service took five events of the eight and six cups of the nine given as prizes. The mechanics, too, are more experienced. Last year was a pioneer year. Then the pilots were learning the routes they were flying and the field and hangar equipment was inadequate. During the fiscal year ending June 30, 1921, seventeen people died in accidents in the Air Mail Service. Many of the fatalities occurred with the metal monoplanes which were abandoned. During the last fiscal year one pilot was killed. His death occurred on July 16, 1921, but no man has met death in the Government Air Mail Service since then. In the last year no flyer has been in the hospital more than five days.

The Air Mail Service is now maintaining sixteen stations on the ocean-to-ocean route. Fifty-six planes are ready to fly. In addition, some are being overhauled and some are in storage waiting to be assembled. The Air Mail Service is employing forty of the most expert pilots in the United States. The total number of men employed to fly the planes and to keep them in repair is 372. Every day twenty-one pilots and planes are in the air, flying approximately 6,000 miles. The speed possible by the use of the Air Mail is shown by the fact that mail sent from New York has been delivered in San Francisco three days later.

The Post Office Department expects to establish night aerial mail service on the transcontinental route within this fiscal year. At present the planes are used chiefly to advance mail delivered too late to catch trains on which earlier mail left, but night flying planes will carry mail from New York to Chicago or from Chicago to Cheyenne.

(Concluded from page 401)

a definite plan. For months there had been under consideration a flying meet and congress, but definite action was not practicable until the last fortnight, when a representative of the Chicago Aeronautical Bureau called on us. The plan is to hold a flying meet and convention, August 4 to 13, to which no admission will be charged. The purpose is to develop Chicago's position in air transportation. The president of the Chamber and others, including Messrs. Curtiss and Redden, have accepted invitations to speak. The meet, as presented to us, has our hearty approval and it is recommended that the Chamber sanction it and otherwise assist it in every way possible.

Aeronautical Institute: There has been under consideration the desirability of an Aeronautical Institute. It now appears that at the time of the Pulitzer Races in Detroit the program of the Detroit Aviation Society includes the organization of an Air Congress in connection with the effort that is being made to perfect the National Aeronautic Association. In the replies that we have received to our questionnaire on this subject there is considerable divergence of opinion on this subject. This, in a measure, is due to a misunderstanding of aims, scope and purposes of such a plan. Many of our members assumed that an Air Institute would be limited to consideration of engineering problems and consequently recommended that the work be left entirely to the S. A. E. As a matter of fact, a program for an Aeronautical Institute would not only include papers on engineering subjects, but consideration of questions of aerial law, national and international policies, insurance, military and naval use of aircraft, organization of aerial transportation companies, both as to personnel and finance, etc., etc.

Co-operation with Local Chambers of Commerce

As we are increasing our contact with local Chambers of Commerce we receive increasing demands from these organizations for co-operation. They are gradually forming the habit of not only referring to us the peculiar questions of their locality regarding landing fields and the establishment of air lines, but the inquiries that they receive from individuals on aeronautical questions.

Sales Information

We have an increasing number of requests for information regarding sources of supply for aeronautical material, which is regarded as a very wholesome sign, not only as indicating the manner in which our organization is being used, but the increasing interest on the part of the public in aeronautical development.

President Harding's Letter

Following is the letter, mentioned above, which the Aeronautical Chamber of Commerce received from President Harding:

"The White House,
"Washington.

"Gentlemen:—

"I find pleasure in adding a word expressive of my interest in aerial transport, and in the presentation of the subject which is being made by the Aeronautical Chamber of Commerce. The history of civilization is largely the history of communication. Each stage of progress seems to demand and develop improved means of transport. The steamship, the railroad and the motor car have been devised and utilized. Now we enter a new phase. It is a real distinction to America to be known as the birthplace of the aeroplane; it should be our concern that this art shall not languish, but that in its practical application we shall lead the world. An amazing development will take place in the near future in the utilization of the air as a medium of transport and communication. As a government, we are aiming to provide this art with necessary guaranties of law, and with such facilities as may be possible through the encouragement of airways and terminals. But for air transport quickly to achieve the important place it is destined to occupy it must have public interest and support. I hope your efforts in this behalf may be productive of most gratifying results.

"Very truly yours,
"WARREN G. HARDING.

"Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City."

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New York-Atlantic City Service

Passenger accommodations to fill a six-place flying boat daily from Atlantic City to New York have been booked for one month in advance, the Aeronautical Chamber of Commerce announced in connection with the regular daily service each way by Aeromarine Airways. Their flying cruisers will leave the municipal flying station at Eighty-second street, North River, every afternoon at four o'clock. The flying boats will leeave the Curtiss Airport at Atlantic City at ten o'clock in the morning for New York. The trip between the two cities is made entirely over the water. It will require only 75 minutes, as against three and a half hours by train.

B-G Expansion

Owing to the fact that the demand for B-G spark plugs has increased so tremendously the company has had to take larger office and factory space at 136 West Fifty-second street, New York.

Navy Department Test of Wright Engine

The Navy Department has had a quiet way of doing a considerable amount of development work on aircraft engines during the past two years. An interesting evidence of this is the recent completion of test of 250 hours on a Wright E-2 engine. This engine was run for two periods of 125 hours each. One hundred and twenty-five hour runs were continuous, twenty-four hours a day, the only stops being three in each period due to gasoline shut off, trouble with oil radiator leakage, spark plug renewal and the necessity for club renewal, as part of the test was conducted in a rainy period.

This engine was run at the rated horsepower of 180, and a rated speed of 1800 r.p.m. on straight aviation gasoline. While the results of the test are not for publication as yet, it is understood that the Navy Department is well pleased with the tremendous durability shown by the engine and it is also understood that the Wright Company intends to incorporate in future production engines several modifications of the standard E-2 which were tried out during this test. Representatives of the Wright Corporation who observed the test are enthusiastic about the way the men of the Bureau of Aeronautics on duty at the Naval Air Station at Anacostia, D. C., handled the running of this very arduous bit of research work. One of the most interesting points in connection with this endurance test is that the connecting rod bearings, which were the weakest point in the original type "A," 125 H. P. Hispano engines, from which the present engine was developed, ran for the full 250 hours and showed no measurable wear in that period; also that the valves which were regarded as being very delicate in the early engines were in such a condition at the end of the test that they would have undoubtedly run another full period of 125 hours.

Flying School Data Wanted

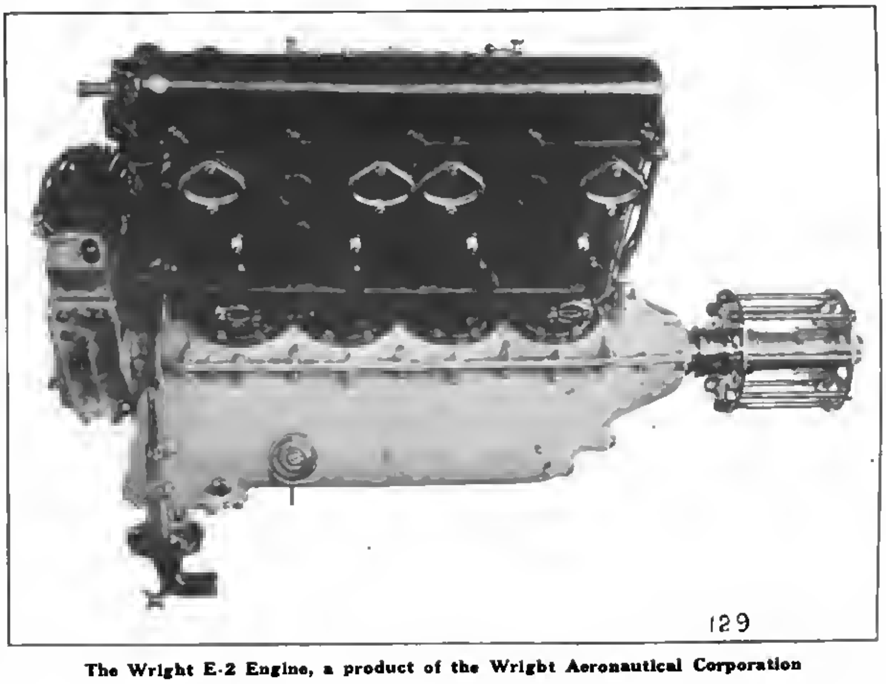
The Aeronautical Chamber of Commerce are preparing data on flying school activities during the past year, and all schools are requested to send the approximate number of pupils turned out during the past 12 months, with photographs of activities where practicable.

Photographic Opportunity

The Aeronautical Chamber of Commerce has received a communication from Mr. Theodore G. Holcombe, Secretary of the Committee on Post Office and Postal Facilities, of the Boston Chamber of Commerce, 177 Milk Street, Boston, Massachusetts, requesting information relative to the cost, etc. of an aerial survey of Boston. He desires, for his files, the names, etc. of reliable firms engaged in aerial photography, that they may be available in case an aerial survey is decided upon.

Standard Atmosphere

Report No. 147 of the National Advisory Committee for Aeronautics, by Willis Ray Gregg, discusses the need of a standard set of values of pressure, temperature and density at various altitudes and points out the desirability of adopting such values as are most in accord with actual average conditions, in order that corrections in individual cases may be as small as possible. To meet this need, so far as the United States is concerned, all free-air observations obtained by means of kites and balloons at several stations in this country near latitude 40° N. have been used, and average values of pressure, temperature and density, based upon those observations, have been determined for summer, winter and the year and for all altitudes up to 20,000 meters (65,000 feet). These values are presented in tables and graphs in both metric and English units; and in the tables of densities there are also included values of density for other parts of the world—more particularly for Europe. A comparison with these values shows that, except in the lowest levels, the agreement is very satisfactory. A further comparison with



The Wright E-2 Engine, a product of the Wright Aeronautical Corporation

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values of density determined from Toussaint's law of temperature decrease, t = 15 — .0065z, in which t is the temperature in ° C and z the altitude in meters, indicates very good agreement with those values up to 10 kilometers. It is therefore recommended that the United States adopt Toussaint's values of density up to 10 kilometers and the values presented in the tables for all higher altitudes.

A copy of Report No. 147 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Triangle Airways

The Triangle Airways of Chicago operated their two six-passenger flying boats from Chicago to Michigan City on July 4, to transport fans to the Leonard-Rocky Kansas bout. Short flights are made regularly by the company from the old Columbia Yacht Club.

The Slotted Wing

We are in receipt of the following letter from C. A. Wragg, aeronautical engineer, Washington:

In the article on the "Theory of the Slotted Wing" by A. Betz, Gottingen, printed in your issue of June 26th, reference is made to the type of wing system (Fig. 5) in which a wing section is set close behind and below another to make a compound aerofoil unit for normal flight. It is stated that the flow about the forward wing is improved by the proximity of the rear one, but that the effect of the forward wing on the flow about the rear one is such as to detract from the advantage gained.

The writer pointed out this improvement on a forward section in such a wing system years ago, and also stated that not only could the detractive effect on the rear wing be minimized sufficiently to make the arrangement worth while as a fixed non-adjustahle system, but that the airflow about a rear section set close behind and helow can be affected in such a way as to augment the efficiency of each section and result in improved efficiency of the compound. He claims to be the first to point this out and has for many years advocated and endeavored to instigate a thorough investigation of this Compound Aerofoil.

Qualitative data obtained hy the writer indicate that not only can the L/D be improved by emhodying the requirements which he specified, hut that this can be in a measure affected by reduction of drag at the low angles and values of lift used for maximum speed.

The system can therefore he ideally adapted for high speed, and hy making certain simple mechanical adjustments it can be changed during flight to considerably increase the lift coefficient by reducing or closing the gap (the reverse operation of the Lachmann and Handley Page idea) for the purpose of landing and rising.

Aeromarine Airways Opens Great Lakes Division

The Aeromarine Airways, Inc., officially opened a daily flying boat service between Detroit and Cleveland with the arrival of two eleven-passenger, closed-cabin flying boats, the *Santa Maria* and the *Wolverine*, in Cleveland after a 90-minute flight from Detroit on July 14.

On board the *Wolverine*, which was piloted by E. D. Musick, were C. F. Redden, president of the Aeromarine Airways, Inc.; W. E. Metzger, president of the Detroit Athletic Club; Commodore A. A. Schontz, president of the D. & C. Steamship Company; P. J. Reid, managing editor of the Detroit *Free Press;* H. V. Wilcox, of the Detroit *News*, and Roland Rohlfs, Detroit manager of the Aeromarine Airways, Inc.

On board of the *Santa Maria*, which was piloted by D. G. Richardson, were I. M. Upperque, president of the New York Cadillac Motor Car Company, and owner and president of the Aeromarine Plane & Motor Company, the parent corporation; C. F. Ketterling, vice-president of the General Motors Company; Dr. J. W. Inchec, Commissioner of Police of Detroit; Carl Fritchie, of Detroit; Frank Lewis, of New York; T. Norris, motion picture photographer; C. S. Mott, general manager of the General Motors Company, and a representative of the Detroit *Journal*.

The boats arrived at Cleveland at 12:20 p. m. The distinguished passengers were greeted by a committee from the Cleveland Chamber of Commerce. Glenn L. Martin, of the Glenn L. Martin Aircraft Corporation, headed the welcoming delegation. H. A. Bruno, sales and advertising manager of the Aeromarine Airways Company, and Walter Hempel, field representative of the company, were also at the dock when the boats arrived.

The visitors and welcoming committee were driven in Cadillac automobiles from the dock to the Cleveland Chamber of Commerce. The procession was escorted by a troup of mounted police. At the Chamber of Commerce they were met by Mayor Fred Kohler, and Newton D. Baker, president of the Chamber of Commerce, gave an address of welcome and complimented Mr. Upperque and Mr. Redden on the initiative shown by the Aeromarine company in developing commercial aviation in America.

The party returned to the flying boats at 3 o'clock p. m. and at 3:22 p. m. the boats left the water on their return flight to Detroit, arriving there at 4:41 p. m.

The Cleveland station of the Aeromarine Airways, Inc., is at the D. & C. dock at the foot of East 9th street. Tickets and reservations may be made at this station and also at the uptown office of the D. & C. company, 2010 East 9th street.

In Detroit the operating base is in the Memorial Park and the river. The downtown passenger station is at the foot of First street. Tickets may also be had at the D. & C. offices. The operating equipment for this service is up-to-date in every way. Fast motor boats and base floats were shipped from the Aeromarine factories at Keyport, N. J., and are stationed at the different bases. Through the cooperation of Commodore Schontz, Aeromarine passengers have the use of the D. & C. waiting rooms at both cities. The boat schedules are as follows:

Leaves at 9 a. m. from Cleveland and Detroit. Returns at 5 p. m. from each city. The fleet consists of the *Santa Maria*, the *Wolverine*, and a six-seat open boat, the *Niagara*. Another eleven-passenger flying cruiser has been ordered from the factory and will join the fleet within a few days. This boat was named the *Buckeye*.

Air Mail Radio Service

Plans are being considered by the Post Office Department for changing at least a few of the fifteen radio stations operated in connection with the Air Mail Service to provide both radio telegraph and radio telephone service. The stations are at Washington, D. C.; Hazelhurst, L. I.; Bellefont, Pa.; Cleveland, O.; Bryan, O.; Chicago; Iowa City, Ia.; Omaha, Neb.; North Clark, Neb.; Cheyenne, Wyo.; Rock Springs, Wyo.; Salt Lake City, Nev.; Reno, Nev., and San Francisco.

The Washington station has had both radio telegraph and radio telephone service for nine months. Besides maintaining an hour-to-hour record of the progress of air mail, the Post Office Department radio stations now send out other information. Complete weather reports now go out daily. Also reports of grain, dairy and livestock prices travel the ether waves to the farms and farming communities.

It is still uncertain just when the stations will be changed to radio telephone apparatus. Because of the first call on the radio by the Air Mail, the equipping will probably be gradual. Further announcements concerning the new service are expected within a short time.

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ARMY and NAVY AERONAUTICS

Navy Prepares for Detroit Races

The Navy is making extensive preparations for the forthcoming aerial contests to be held in Detroit in October and it is hoped and confidently expected that the Pulitzer Trophy and the Curtiss Marine Flying Trophy will fall a prize to Navy contestants.

In the Pulitzer Race, the Navy will make five entries, among which will be the Curtiss Navy Racer CR-1, winner of the event in 1921. This plane holds the world's record for a closed circuit. The CR-2, another entry, is a modification and improvement over the CR-1, and will undoubtedly be heard from. Two Booth Racers, BR-1, supplied by the Aerial Engineering Corporation, have a designed speed of 216 miles per hour. One MB-7 (Thomas-Morse Monoplane) of tried and proven ability and having exceptional qualities of manoeuverability will be entered, and stands an excellent chance of winning the race.

In the Curtiss Marine Trophy Race, the Navy will have ten and possibly eleven contestants, which include two TRs, two TSs, and two Curtiss Triplanes, 18T type. Other entries in the Curtiss Race will be an HA Fighter, a Gallaudet D-4, an H-16, and a VE-9.

Intensive training of pilots is projected for the summer in preparation for the contests. They will be sent to Detroit in September and there continue training and familiarize themselves with the course.

The Detroit Races were originally scheduled for September, but recent advices from The Detroit Aviation Society postponed the dates of the Curtiss Race to October 7th and of the Pulitzer Race to October 12th.

The Baby Bomber

The air flivver has arrived. It is driven by a 17 horsepower motor taken from a popularly known motorcycle, which its huilder used to ride.

This little plane was constructed at McCook Field hy O. H. Snyder, one of the aeroplane experts. It is 16 feet in length and has a wing spread of 21 feet. It weighs less than 400 pounds and is the smallest thing that flies at McCook Field, where it is affectionately called the "Baby Bomher."

Lieutenant John A. MacReady, who holds the world's record for altitude, 42,800 feet, recently put the Baby Bomber through her paces in a two-hour flight. She did everything that a regulation plane can do. On a straightaway flight she made 62 miles an hour, was then throttled down to 21 miles an hour in landing and came to a dead stop in 40 feet. In taking the air she requires a runway of from 150 to 200 feet.

MacReady declares the little flier rides easy, is well proportioned and evenly balanced.

Snyder superintended the construction of the baby and built nearly all of it himself. Consumption of oil and gas is no greater than that required to send a motorcycle down the pike at 45 miles an hour.

Snyder believes that his little machines can be developed commercially and fill a need which is manifesting itself in aviation.

A Chain of Air Routes Across the United States

The latest project of the Airways Section, Office Chief of Air Service, is the formulation of a plan for the thorough investigation of practically 90 per cent of the proposed Airway System of the United States. Letters of instructions have already heen sent out to the various Army Air Service flying fields, designating certain routes over which pilots from those fields should fly. Upon the completion of the initial investigation of the routes tentatively selected, and after a decision is reached as to the most advisable routes to fly over, the Army Air Service contemplates making arrangements for the inauguration of a regular bi-weekly aeroplane patrol over these routes, to enable pilots of the various fields to ascertain from time to time the condition of landing field facilities in the district allotted to them.

Pilots will be required to promptly report any field previously selected which has since been plowed up or otherwise rendered unsuitable for landing.

The object of establishing a system of air routes across the continent is to enable the Army Air Service to plan cross-country flights of a special nature, such as maneuvers, etc.

The establishment of this transcontinental airway system should prove of material aid to commercial flying and stimulate long-distance flights. Flights across the United States will not be of such a rare occurrence as at present, and it is possible, in view of the great saving of time, such flights will become popular, since they will curtail a journey of at least five days by train to two days at the most.

Transfer of Photographic School

The transfer of the Photographic School from Langley Field to Chanute Field, Rantoul, Illinois, marks the removal of what may be considered as one of the landmarks of Langley Field. The original school was established here in the Summer of 1917, soon after the organization of the Photographic Division of the Signal Corps. British advisory officers in the persons of Major Campbell and

The Baby Bomber designed and constructed by O. H. Snyder at McCook Field

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Sgt. Major Haslett were among the first to arrive to teach the new use of photography from aircraft. These officers were also pioneers aerial photographers of the British Army.

At this time, Langley Field was just beginning to take form. The first Photographic School building was built by the students, many of them newly commissioned reserve officers. The personnel was at first quartered in what was known as the "old red barn," only the foundations of which may now be seen. The first class was graduated in the Fall of 1917, and some of the graduates were sent immediately overseas, others to flying fields and still others established schools of aerial photography at Post Field, Cornell University and Kodak Park, Rochester, N. Y. The latter was probably the largest school of photography ever operated, having had, at one time, as many as 800 students under instruction. The Cornell school a few months after its establishment, became the training center for photographic officers.

With the organization of other schools, the parent school became the school for aerial observers and continued as such until the Armistice. After the closing of the schools at Rochester and Cornell, the Air Service Photographic School, as it is now constituted, was re-established at Langley Field in the Summer of 1919.

The photographic laboratories and facilities of the Photographic School are probably unsurpassed by any similar school. Since its establishment three years ago, upward of fifty officers and one hundred and fifty enlisted men have been graduated.

Mexican Officers Visit Kelly Field

General Covarrubias, of the Military College of San Jacinto, Mexico, with his staff, visited Kelly Field on May 16th and was highly pleased with the aerial demonstration given at the field and much impressed with the possibilities of bombardment and attack aircraft in use against rebels and bandits in his country. The 2nd Photo Section took a number of pictures of the General's party and they were developed, printed and dried, labelled and presented to the party before they left the field. Four formations of five planes each passed before the reviewing stand in honor of the visitors.

Admiral Fullam Praises Bombardment Pilots

The morale of the Bombardment Group at Kelly Field went up another peg following Rear Admiral Fullam's address in San Antonio recently on the "Possibilities of Aviation," in which he praised the unparalleled feats of the bombardment personnel in the battleship sinking business last summer on the Atlantic coast and foretold some of the amazing possibilities of aerial bombardment. Of course, the members of the Group know all these things, but they like to hear others say them just the same.

Advanced Students at Kelly Field to Graduate

The present class of student officers and cadets has about finished their advanced bombardment training. There has been only one major crash during the present class. Cadet Halpin, on May 16th, attempted to make a forced landing in a small muddy field and wrecked the aeroplane. He escaped without serious injury.

Spraying New England Forest

Following previous experience in connection with the spraying of trees by aeroplane, plans have been formulated for spraying a section of the New England forest by this method. Captain R. A. Kinloch, Air Service, on duty with the 1st Squadron at Mitchell Field, L. I., New York, was detailed on this duty and departed for Boston, Mass. He investigated landing field facilities in the vicinity of the forest to be sprayed, and has been in consultation with the representative of the Department of Agriculture who was assigned to conduct the experiment.

Setting Up of Martin Bombers

The L. W. F. Engineering Corporation recently completed setting up and testing the first of the thirty-five Martin Bombers to apply on their contract for the Government. The first plane was flown by the test Pilot, Lieutenant Wade, of McCook Field to the Aero Marine Plant at Keyport, New Jersey, to be used as a model Work is now in progress by the Curtiss Corporation in setting up at Mitchel Field the first of the Martin Bombers which that corporation is building for the Army. This plane is now practically ready for test. It is understood that the Curtis Corporation will turn out one Bomber per week, all of these to be set up at Mitchel Field.

High Parachute Jump at Kelly Field

Master Sergeant Chester W. Kolinski, of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, made a successful parachute jump on May 24th from an altitude of 10,600 feet, so far the highest jump made by any member of the parachute school during the present course. The training pack chutes were used, and the ship was piloted by Lieutenant J. H. Doolittle. Both chutes functioned perfectly.

A Memorial at Love Field

At the entrance to Love Field, Dallas, Texas, there now stands a small granite monument, which was dedicated on May 30th last in memory of the twelve officers and cadets of the Army Air Service who made their last flight at that field. As Love Field is to be abandoned as a flying field and may soon lose its identity, this landmark was erected in their honor. The memorial bears the individual bronze name plates which formerly hung in the Officers' Club at that field.

The dedicatory services were very impressive, and hundreds of people were present to pay their silent respect to the memory of the departed flyers.

General William R. Smith, commander of the 36th Division and veteran of the World War, paid a high tribute to the momory of the men who gaves their lives during America's hour of stress. He declared that the progress of the aeroplane in the last war has shown conclusively that this method of warfare will continue to grow in importance, and that in event of future wars a still greater part will be played by the plucky and fearless men of the air. "They are honored dead," he said. "What they did in their struggles to master the air will be felt immeasurably as time flies on. Those martyrs who staked their lives in preparing for their needed service overseas did not die in vain. We owe them all honor and credit." As he stepped from the raised platform, he swept his cap from his head, which was the signal for the planes sent from Kelly Field, Ellington Field, Post Field and Love Field to take the air and circle the field. The planes rose gracefully and passing over the memorial shaft in rapid succession showered wild flowers upon the granite slab.

Other speakers were Herman Whisnant, who was an officer of the First Division and lost his leg in the Soissons campaign; Charles L. DeBow, chairman of the arrangements; Major Jed C. Adams, and Mrs. S. M. Fields, president of the Southern Memorial Society, who placed beautiful wreaths on the stone, with short impressive and touching remarks. Near the front of the shaft the emblem of the American Air Service was placed by the women of Love Field.

The officers and cadets whose name plates are on the monument are as follows: 1st Lieut. Rex Everett Field, 2nd Lieutenants Charles James Hyde, Parker Pruce, John Maxwell Widenham, Arthur Anthony Sego, Jr., Ralph Phelps Collier, Robinson E. Bidwell and Cadets Victor Leon Dennis, John William Albert Insinger, Ralph Eldon Stall and James Forester Dick.

This memorial was the idea of Lieutenant Marion G. Putnam and

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was his personal contribution to the memory of these men, many of them having been his friends.

General Patrick Visits Chanute Field

General Mason M. Patrick, Chief of Air Service, and his party, arrived at Chanute Field by aeroplane from Milwaukee on Wednesday, May 31st. The officers comprising the party were Major H. A. Dargue, Major P. Van Nostrand, Major Wm. C. McChord, Air Officer, 6th Corps Area; Capt. W. C. Ocker and Lieut. H. K. Ramey. General Patrick made a thorough inspection of the field and left on Friday, June 2nd. Major Van Nostrand remained at the field and accompanied Lieut. Frank M. Paul on a cross country trip to Iowa City, Iowa, and thence to Scott Field, Belleville, Ill. Lieut. R. R. Fox also made this trip, the purpose of which was to map an air route from Scott Field to Chanute Field and other points.

Aerial Ambulance

Under orders from the Department of War all flying fields in the United States are to be equipped with the new type of aero ambulance recently developed by the engineering division at Wilbur Wright Field, the largest aerial supply depot in the Army Air Service.

Ambulances are in various stages of construction at the present time and will be delivered to the fields as rapidly as they are finished.

The new type is known as the Curtiss J N 68. It is driven hy a 180 horse power Hispano motor.

The litter carrier or stretcher compartment is located in the fuselage near the center. It is entered through a door in the side and extending across the top. It is connected with the physician's cockpit by means of portholes. The pilot's cockpit is right out in front.

The first model built has been successfully tested and given the official O. K. by the department.

Promoting the Establishment of Landing Fields

The trip recently made by Captain St. Clair Streett, Air Service, on duty in the Airways Section, Office Chief of Air Service, for the purpose of making a general survey of landing field facilities in the Eastern and Middle West sections of the United States, was productive of excellent results and, it is helieved, will ultimately result in the establishment of a network of landing fields in these sections of the country which will go a long way in not only extending the field of commercial aviation but also in increasing the element of safety in flying.

In the various localities visited by Captain Streett the various commercial aeronautical concerns, as well as the municipal authorities, aero clubs, chambers of commerce, etc., were made acquainted with the efforts being made hy the Army Air Service to encourage the growth of commercial aviation. Captain Streett states that at those places visited where commercial aviation concerns had been actively operating there prevailed a marked enthusiasm for aviation and a willingness to co-operate in any manner possible. It is his contention that it is the duty of every Army pilot to educate the public in the safe and sane usage of the aeroplane; with the fact that by its use one is enahled to cover long distances in a short space of time; that with the existence of adequate landing fields regular schedules of flight can be maintained without interruption, since with aviation equipment developed to its present degree of efficiency it is very seldom nowadays that it is found necessary to postpone flying on account of unfavorahle weather conditions.

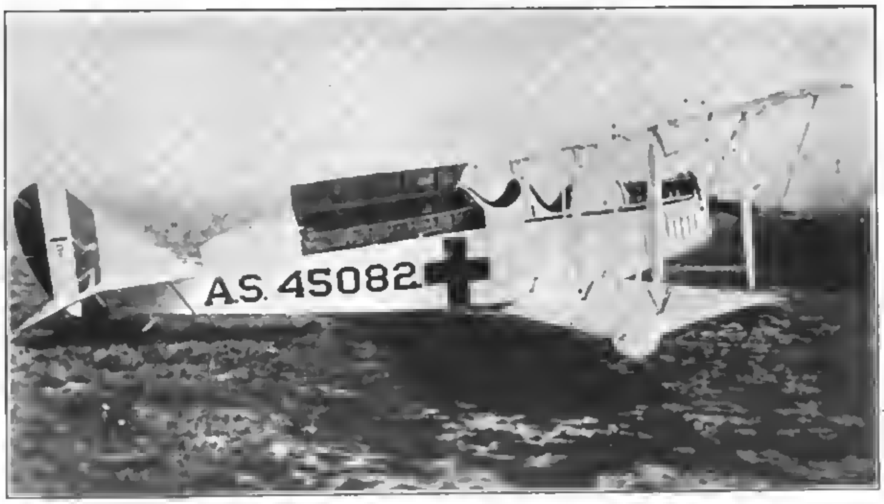
Aside from the primary purpose of the trip, that of boosting commercial aviation and securing all available information on landing field facilities, much useful data was obtained which will aid in the preparation of standard maps.

The itinerary of the trip was as follows: Moundsville, W. Va.; Columbus, Ohio; Dayton, Ohio; Indianapolis, Ind.; Louisville, Ky.; Camp Knox, Ky.; Kokomo, Ind.; Wabash, Ind.; Lafayette, Ind.; Rantoul, Ill.; Belleville, Ill.; St. Louis, Mo.; Fulton, Mo.; Kansas City, Mo.; Fort Leavenworth, Kan.; Lincoln, Neb.; Omaha, Neb.; Des Moines, Ia.; Cedar Rapids, Ia.; Iowa City, Ia.; Davenport, Ia.; Monmouth, Ill.; Chicago, Ill.; Milwaukee, Wis.; thence back to Dayton, Ohio; Toledo, Ohio; Camp Perry, Ohio; Cleveland, Ohio; Buffalo, N. Y.; Rochester, N. Y.; Syracuse, N. Y.; Utica, N. Y.; Schenectady, N. Y.; Albany, N Y.; Boston, Mass.; Hartford, Conn.; New York City; Baltimore, Md.; Washington, D. C.

Despite the fact that for five days during the trip between Dayton and Rochester rainy weather prevailed practically the whole time the plane was in the air, the whole trip was accomplished without incident. The plane used was a DH4B, which covered approximately 4,000 miles, the entire trip consuming five weeks.

Dr. S. M. Burka, of McCook Field, accompanied Captain Streett on the trip from Dayton to Omaha and return, while Lieutenant George W. Goddard was the passenger on the remainder of the journey back to Washington. Photographs were taken of all possible landing places whenever the weather permitted, and sketches were made of all fields visited.

Data was obtained from commercial aviation operating companies on their past operations and on their plans for the future. A number of cities visited either have adequate landing facilities or contemplate the immediate establishment of same, viz.: Louisville, Columhus, Kokomo, Wabash, St. Louis, Fulton, Kansas City, Lincoln, Omaha, Des Moines, Davenport, Monmouth, Chicago, Milwaukee, Buffalo, Rochester, Utica, Schenectady, Albany, Boston, Hartford and Baltimore. At the present time facilities are available at all of these cities where landings can be effected, and at every one of these cities the Chamber of Commerce and civic officials, as well as commercial aeronautical firms, invite Army and civilian pilots to use their facilities. Detailed information with regard to the landing facilities at the above-mentioned localities can be obtained from the Airways Section, Office Chief of Air Service, Washington, D. C.



U. S. Army Type Aerial Ambulance

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A British Cross-Channel Seaplane Serivce

An Air Ministry communiqué, issued on June 14th, makes a definite statement as to the cross-Channel seaplane undertaking which has for some time past been the subject of vague rumor. The scheme, which is to be operated by a company now in process of formation, probably with the title of "The British Marine Air Navigation Company," has been approved by the Air Ministry, and will be operated under the general terms of the subsidy scheme which was published in June, 1921.

Services are to be run by seaplane between Cherbourg and Southampton, and Le Havre and Southampton, the main object of the scheme being (a) to shorten the cross-Atlantic journey to London by picking up passengers at Cherbourg and bringing them to Southampton, and (b) to speed up the London-Paris service *via* Southampton and Le Havre by carrying passengers and mail by seaplane instead of by boat. Subsequently, it is proposed to operate a passenger and mail service between Southampton and the Channel Isles.

The services are to be carried out by aircraft designed and built by the Supermarine Aviation Works, Ltd., of Southampton. The scheme has the support of the London and South-Western Railway Company, who will actively co-operate in the matter of through bookings and railway connections, and the French railway companies concerned are to assist by providing suitable train connections for the through route to Paris.

The operating company will receive as subsidy 25 per cent of the gross earnings from passengers, goods and mail, plus a payment of £1 10s. per passenger and 1½d. per lb. of goods carried. These latter sums are half of the similar payments made on the London-Paris route.

This enterprise marks a very important step forward in the development of real commercial aviation, and everyone who is acquainted with the history of the Supermarine Aviation Works, Ltd., will hope that the venture will be as successful as it deserves to be, and will bring to them—as the constructors of the machine to be used—an adequate reward for their persistent faith in the value of marine aircraft for transport purposes.

French Aero Salon

December 15th next to January 2nd, 1923, is the date fixed for the next French Aero Salon—the eighth—to be held, as before, at the Grand Palais. The exact title has been changed to "Exposition Internationale de l'Aeronautique."

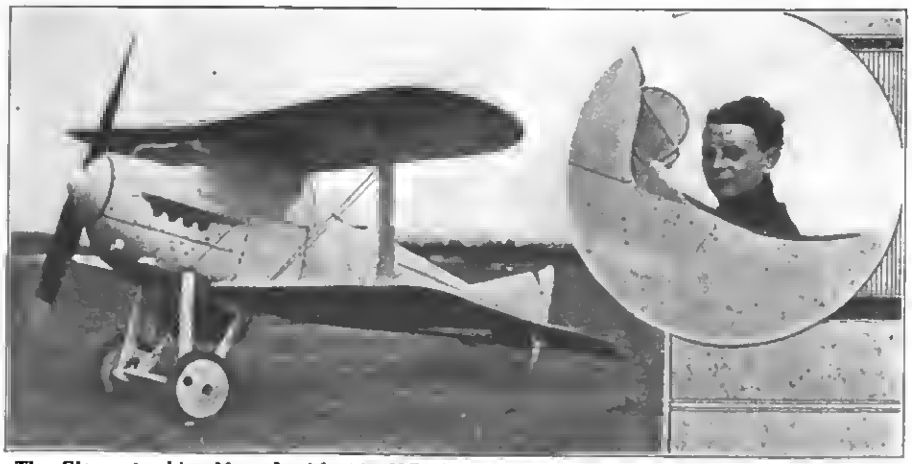
Italian Competition Entries

The results of the entries to the International Idro-Aviation Race of the Schneider Cup which closed on May 31st, according to the Italian National Aeronautical Federation, are as follows: *Italy*—5 machines—Two of the Macchi Firm, two of the Societa' Idrovolanti Alta Italia and one of the Pegua & Co. Among these three must be chosen. *France*—2 machines to be designated. *England*—2 machines to be designated.

The results of the entries for the Angelo Berardi Balloon Race are the following: *Italy*—8 ballons. *Belgium*—2 balloons.

The Berardi Balloon Race will take place June 4th in Milan.

The entries for the International Race for the Tyrrenean Cup and Grand Prize of Italy have been deferred until June 30th, 1922.



The Gloucestershire Mare I with 450 H.P. Napier Lion and Capt. James, who piloted the machine recently in England at 210 miles per hour

S. B. A. C. Officers

Mr. C. R. Fairey, M. B. E. (Chairman of the Fairey Aviation Co., Ltd.), has been elected Chairman of the Society of British Aircraft Constructors for the year 1922-23. Capt. P. D. Acland (Vickers, Ltd.) has been elected Vice-Chairman and Sqdn.-Comdr. James Bird (Supermarine Aviation Works, Ltd.) Hon. Treasurer.

Sir Henry White-Smith, C. B. E., the retiring Chairman, who has been Chairman of the Society since its formation in 1916, becomes Past-Chairman.

Twenty-Nine Days vs. Eight Days by Air

The Postmaster-General states that the air mail for Baghdad which was dispatched from London on May 18th reached Baghdad on May 26th. This was a particularly notable achievement, as the normal time occupied in transmission by the combined ordinary and air route is between 11 and 18 days, and by ordinary route all the way it is about 29 days.

Dutch Parcels Air-Post

The Postmaster-General announces that parcels addressed to any part of Holland may now be posted for conveyance from London to Rotterdam and Amsterdam by air and for express delivery by the Dutch Post Office. Parcels will be accepted at the Post Offices in London and in the larger provincial towns where air parcels for Paris and Brussels are already accepted. The scale of charges, inclusive of express delivery at the place of destination, will be as follows: For parcels weighing up to 3 lb., 4s.; 3-7 lb., 7s. 6d.; 7-11 lb., 10s. 6d. On parcels addressed "Poste Restante" the charges will be 6d. less.

There will be two dispatches by air each day. Parcels posted in London overnight, and, in the provinces, in time to be included in the night parcels mails to London, will normally be forwarded by air next morning and delivered in Rotterdam and Amsterdam the same evening, and in other parts of Holland by the second morning after posting. They should thus reach their destination two or three days earlier than if sent by the ordinary parcel service.

Another Polar Trip

Plans for Major Tryggve Gran's aeroplane flight across the North Pole from Spitzbergen are well under way. With his expedition he has been in Spitzbergen since May 29, and the company is now engaged in a survey of conditions in the neighborhood of Mourning Bay looking to the choice of a starting point.

With Major Gran are the relief pilot, Lieut. Richards, formerly of the British

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Royal Air Force, who holds the record for the fasted flight from India to London; Thorlief Haug, a famous Norwegian skiing expert, and Jacob Tullin Thams, a navigator. They left Christiania May 20, without knowledge that Capt. Roald Amundson was then on his way to Nome to make ready for his projected flight across from Point Barrow, Alaska, in the opposite direction to that which they contemplate.

Aftenposten, the newspaper, is bearing the expense of the expedition, together with friends of Gran. Gran intentionally kept secret that he would try to cross the North Pole, to exclude competition.

Officially, the expedition's only determination is to find out whether aeroplanes can be useful to help seal hunters.

"Aeroplanes will quickly be able to find the seals' resting place and instruct hunting boats by wireless," Gran said before leaving Norway.

Major Tryggve Gran is one of the great adventurers of Europe. He comes of a noble Norwegian family and has been flying for the past twelve years. He was one of the first aviators to loop the loop, and in 1914, when a Lieutenant in the Norwegian Navy, made the first aeroplane flight across the North Sea.

One incident of this flight illustrates vividly the strides that have been made in aviation in recent years. In 1914 there was no such thing as an inclinometer, and knowing that he must fly through fog, Gran hung a lead plummet on a string before him in his cockpit. He had need of it, too, for in the course of his flight, and in the midst of the heaviest sort of a fog, he found the plummet hanging clear outside the cockpit. He was flying upside down!

Duirng the war Gran was a Major in the British Royal Force, commanding a bombing squadron in France. At the close of the war he became identified with the transatlantic projects, and went to Newfoundland as navigator of the Handley-Page Atlantic, commanded by Vice-Admiral Mark Kerr, which remained weatherbound at Harbor Grace while Hawker and Raynham adventured and failed, and while Alcock and Brown adventured and succeeded. The Atlantic was not ready for her attempt when the N-C boats got away from Trepassey to carry the American flag first across the sea by air.

Aviation is but one of the daring sports that Gran has espoused. Famous from boyhood for his skill on skis, he went with Scott to the Antartic in 1910 and was one of those who discovered the gallant explorer's body in 1912.

British Subsidy

In the course of a speech at the Annual Reunion of the Independent Air Force, in London, Captain Guest, Secretary of State for Air, stated briefly what the subsidy arrangement did for British constructors as follows:

(1) a direct payment of £3 per head per passenger that they carry; (2) machines on a hire purchase system at a total cost of three-quarters of their value; (3) change of machines at the companies' will; (4) meteorological services free; (5) use of aerodromes and sheds at a nominal charge; (6) Wireless and communication facilities gratis; (7) lighting services for night-flying purposes; and (8) benefits of Inspection and Research.

New Type Seaplane

The London correspondent of the New York *Herald* states that an aeroplane that according to its inventors promises to revolutionize flying soon will be submitted to practical test, according to information in aviation circles here. It is said to be unlike anything ever constructed before and is really a ship with wings. The utmost secrecy is maintained as to the details of its construction but it is said to mark the beginning of an aerial navy.

The plane is so constructed that it will not only float in calm waters, but it is claimed will be able to ride the roughest seas with the same security as an Atlantic liner. It is claimed that it will be equally airworthy. The hull is long, light and slender, without bulkheads. The elasticity of the hull which will make this possible is the outcome of many years' scientific research. The new machine will be a vast improvement on the present type of amphibians.

The experimental machine carries but seven persons, but designs for larger ones have already been made. The aeroplane will carry four or six engines and will be capable of traveling 100 miles an hour. It will be equipped with fog horns, anchors and riding lights. When not in the air it can travel on the water and thus accompany a battle fleet under all conditions.

Machines designed chiefly for commercial service will be able to cross the Atlantic Ocean in less than forty-eight hours, it is claimed, carrying a heavy load.

New Dutch Company

The aeroplane manufacturing industry in the Netherlands is being extended by the establishment at Rotterdam of a new concern, to be known as the National Aircraft Manufacturing Co. (N. V. Nationale Vliegtuig Industrie). This enterprise is to be financed by Dutch capital exclusively and is to have a new factory built specially for aeroplane production.—*Commerce Reports.*

The Fokker Aeroplane Works at Veere, the Netherlands, are now executing an order for 10 "F. 111" passenger aeroplanes, each equipped with a 350 h. p. Rolls-Royce engine. These follow 4 similar machines already constructed and forwarded to Berlin as the equipment for a new aeroplane service between Konigsberg and Moscow, which is being established by the Russo-German Navigation Co. It is announced in the Dutch press that the Soviet Government has already executed a mail carrying contract with the new company.

In the first three months of the current year, 18 flying machines valued at $84,248 have been exported from the Netherlands, as compared with 7 machines valued at $45,000 in the corresponding period of 1921. Of the 18 machines exported this year, 10 have gone to Russia, 2 to the Dutch East Indies and 4 to Germany, the destination of the other two not being known.—*Commerce Reports.*

The Vickers "Vulcan," with 350 H.P. Rolls Royce engine, to be used by the Instone Air Line on Trans-Channel Services

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FOREIGN TECHNICAL DIGEST

The New Two-Seater Junkers Monoplane

The new two-seater Junkers monoplane is built to the designs of Dr. Junkers of Dessau. Owing to the activities of the Aeronautical Commission of Control—which prohibited the building of aircraft in Germany up to May 5th—the machine had to be built in another country. Experimental work on this particular type has occupied some 15 months, and has included tests to discover a satisfactory engine, experiments with wings arranged at the bottom of the fuselage as in previous Junkers' monoplanes, and finally with the present arrangement.

Like the previous Junkers, the machine is of all-metal structure, using the characteristic corrugated thin sheet duralumin covering. The wing, of thick section, built on multiple tubular spars, is of 11 metres span and is built in one piece. It is attached to the top of the fuselage, and its leading edge is cut out to accommodate the pilot's head—very much as in the case of the Fokker F.III type.

The wing is also recessed on its under surface to accommodate the petrol tank—which is fixed actually to the top of the fuselage behind the pilot, but is enclosed by the wing when this is in position.

Behind the pilot and under the wing is a passenger cabin, large enough to accommodate two passengers, with a side entrance on the starboard side.

The undercarriage consists of two axles, hinged to a sort of rudimentary keel below the breast of the fuselage, a pair of thrust tubes, lying behind the axle, but also approximately horizontal, and a nearly vertical telescopic strut, fitted with shock absorbers fixed to the axle ends and to the fuselage side.

The engine is one of the 50 h. p. 5 cylinder radial air-cooled Siemens Halske type, fitted to the nose of the fuselage, and very thoroughly cowled in. The direct driven air-screw carries on its boss a forward projecting cylindrical nose of some length, which is meant to protect the engine from contact with the ground in case of the machine standing on its nose.

The machine is designed for high-speed special transport work—such as newspaper work of the type associated with the name of Mr. Cobham in this country. Normally with full tanks it carries one passenger and a fair amount of baggage. With reduced fuel or with little or no baggage two passengers may be carried.

No precise details of dimensions, weight, or performance are yet available, but it is hoped that these may be available shortly.

New Safety Devices for Aeroplanes

As we note from time to time improvements in construction tending towards greater safety in flying, the conviction is reached that the aeroplane has not yet emerged from its experimental stage and that, through the inventive genius of man, the aeroplane will eventually reach such a state of perfection as to eliminate any further cause on the part of the skeptical-minded to characterize flying as hazardous.

In England there have recently been introduced two new devices for the aeroplane, both of them having to do with landings, admittedly one of the most difficult features of the art of flying. One of these devices is a shock-absorbing type of under-carriage and the other is a self-sealing gasoline tank designed to withstand the stresses set up by gun fire and in crashing.

The first-named invention, the oleo-pneumatic under-carriage, which has been designed by A. V. Roe & Co., of London, England, manufacturers of the Avro "Viper," should prove of great value in reducing the risk of landing on bad ground, and should also be of value for early training and night flying purposes. The *Aeroplane*, London, gives the following description of this invention:

"This gear consists of two main undercarriage legs which are coupled at the base to the axle, the axle again being hinged by two horizontal tubes to the bases of two steel tube Vees situated in line with the front legs. The main legs carr a shock-absorbing device which consists of a combination of oil and rubber, and it is so designed that about half the travel of the telescopic leg is taken on the oil before the rubber is picked up. The detail of the oil valve is "interdit." The rubber shock absorber is in the form of separate rings, so that no trouble is entailed in replacing any particular broken or frayed portion.

On the ground the weight of the machine is carried by a combination of oil and rubber, and as the machine takes off the plunger sinks to its lower limit of travel. On landing the oil takes the first shock, so that by the time the rubber comes into play there is sufficient oil beneath the plunger to prevent bouncing. Mr. Hinkler (pilot of the Avro "Viper" testing this undercarriage) by changing his usual faultless method of landing, has been demonstrating how this undercarriage defies even the most ham-handed of pilots, by deliberately flattening out at various heights ranging up to 20 feet from the ground and then "pancaking," and also by landing at 80 m. p. h. with very little flattening out, but it seemed that no amount of effort on his part could induce the machine to bounce. It pulls up in a remarkable short run, and owing to the wide track of the wheels (6 feet) it is possible to navigate on the ground at almost any sane speed.

From the demonstration, which one witnessed, it would seem that the Avro "Viper" so equipped could land and get out of the smallest and roughest of fields possible without any trouble. As a training machine it might tend to give newly fledged pilots too much confidence and make them careless when passing into less robust machines, but for fully trained pilots it would seem almost ideal and guard the machine against almost any type of cross-country flying accident."

The Crash-proof gasoline tank, above mentioned, styled the "Silvertown Anti-fire Self-Sealing Petrol Tank," which was awarded the first prize in the British Air Ministry competition, calling for fuel tanks that will withstand machine gun fire and crashes without leakage of contents, and which tanks were subjected to the most rigid and exacting tests, is described by the same publication as follows:

"The metal shell or tank proper consists of thin-gauge metal plate butt welded together and of such a form as to permit of a large increase of capacity before bringing any tensile stresses to bear on the metal, with the result that the seams successfully

The New Two-Seater Junkers Monoplane

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withstand the stresses set up by gun fire and in crashing. This end is achieved by dishing inwards each side of the complete tank.

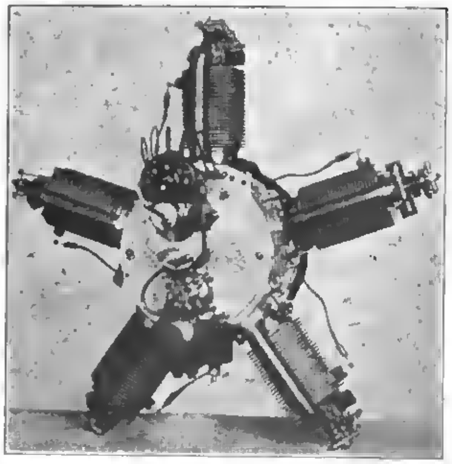
"The patent detachable cover is made of a high-grade rubber about a quarter of an inch thick, formed with an opening large enough to permit of the introduction of the shell. This opening is then closed with a closure piece of the same material suitably fastened in place, and it is claimed that this detachability renders the cover superior to any previous device. The cover can be manufactured and stored apart from the metal shell, and the latter can be removed from its cover and replaced at any time, without in any way causing damage to either.

"The judges appointed by the Air Council consider that the competition has resulted in the achievement of the objects for which it was instituted, and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on Service and Civil aircraft, and which, for a slight increase of weight over and above that of the standard Service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines."

A New Low-Power German Radial Air-Cooled Aero Engine

LIMITED as Germany is to the use of engines not exceeding 60 h.p. for single-seater civilian aeroplanes, there is little doubt that the next two years, after which time the position is to be reconsidered, will see considerable progress made in the efficiency of German aircraft. The conditions imposed will force Germany, if she wishes to fly at all, to make such improvements in her aircraft as will enable it to do the work required with the limited power permitted. Thus, the restrictions may very easily turn out ultimately to be blessings in disguise. While other nations continue, in the main, to rely on power and more power, for increase in performance, load carrying or whatever purpose the particular design is being used for, Germany is prevented from taking this short cut, and will, of necessity, have to effect the necessary improvements by more efficient structural and aerodynamical design.

Whether in anticipation of a limit of 60 h.p. for single-seaters we cannot say, but the fact remains that, just about the time when the latest regulations came into force (May 5) the Siemens-Halske firm, of Siemensstadt, near Berlin, completed and tested a small radial air-cooled five-cylindered engine of approximately 60 h.p. In view of the fact that, up to the present, Germany has not produced many engines of this size, it may safely be assumed that the new Siemens-Halske engine is likely to become popular in Germany in the near future. The new engine has, we understand, been thoroughly tested, and is said to have given good results. We regret that no figures of weight, revolutions, consumption, etc., are available at the moment, but the following general description may not be without interest.



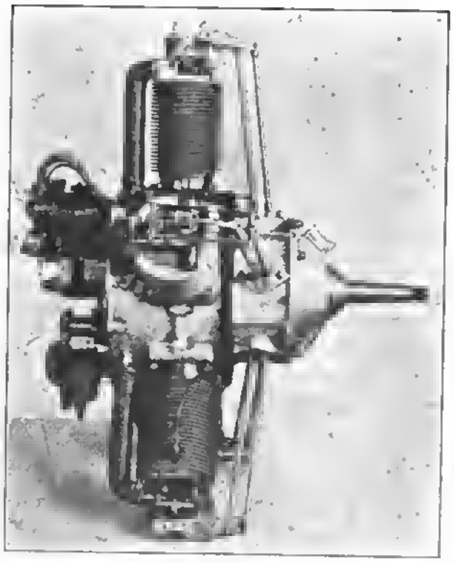
Front View

As will be seen from the accompanying photographs, the Siemens-Halske engine, with but five cylinders, is of very clean appearance, and should not, with suitable cowling, offer a great deal of air resistance. It is of the four-stroke type, with two valves to each cylinder. The bore is 100 mm., and the stroke 120 mm. The cylinders are of steel, with aluminium jackets having fins machined on them for cooling. The pistons are also aluminium, or aluminium alloy.

The aluminium crank-case is in two halves, and the flanged cylinder bases are bolted to it with four bolts each. As already mentioned, there are but two valves per cylinder. The inlet valve is operated by double rockers actuated by a push rod from the cam gear on the front of the engine. The exhaust valve is operated, also *via* push rods, by a single rocker arm, placed between the two rockers of the inlet valve. All rocker arms are carried in ball bearings. The valve stem guide of the exhaust valve is situated inside tubular T-piece, so that the exhaust gases escape through two openings. We believe that the manufacturers have designed a standard exhaust ring collector for this engine, so that from each exhaust valve cage, two short L-pipes run to the exhaust ring, which is placed *behind* the cylinders, and from which a single exhaust pipe projects upward in the typical German style. In the accompanying photographs this exhaust collector ring is not shown.

The rear portion of the crank-case contains the induction chamber, from which the various inlet valves are supplied through straight induction pipes bolted to the crank-case, and to the inlet valve cages. In the front portion of the crank-case are housed the cam discs and the thrust race. Needless to say, the camshaft, which is in two parts, runs in ball bearings. The high tension leads to the sparking plugs are housed in a ring on the front of the engine, and a single pipe carries all the leads from the magneto, which is mounted on a platform on the rear cover of the engine. The oil pump, which forces oil through the hollow crankshaft to the big ends, is also mounted on the rear cover of the crankcase. In its present form, the engine is provided with but one magneto, and there is only one sparking plug per cylinder, but we understand that, if desired, the manufacturers can supply the engine with complete dual ignition.

We hope that later some particulars relating to weight, r.p.m., fuel and oil consumption, compression ratio, etc., may become available, when we shall hope to publish them in AERIAL AGE.



Side View

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ELEMENTARY AERONAUTICS and MODEL NOTES

Bird Flight Principles Compared to the Modern Aeroplanes

By F. F. Davis

THE study of bird flight resulted in men learning to fly, but have they not failed to use the great lesson of the bird's economy of power? And is the aeroplane, as we know it today, the best type of flying machine that can be built? To many, bird flight is a profound mystery, and some say it is impossible to learn much concerning it. Valuable information may be gained, however, by reading the works of the following: Etienne Jules Marey, Otto Lilienthal, F. W. Headley, James Bell Pettigrew, J. W. S. Rayleigh, Prof. S. P. Langley and many others. It will be found that some of these men have made long and careful studies of bird-flight and have used many instruments of their own invention for just that purpose.

By the use of electricity and photography, data has been gathered on the movement and power of birds' wings, close enough for practical purposes. It is found to be something like the following:

	Wing Span	*Supporting Area*	*Weight*	*Horse Power*
Condor	9-10 ft.	10 ft.	17 lb.	0.05
Turkey B'zard	6 ft.	5 ft.	5 lb.	0.015
Wild Goose .		2.7 ft.	9 lb.	0.026
Pigeon		0.7 ft.	1 lb.	0.012
Hu'ming Bird		0.3 in.	0.02 lb.	0.001

Enough Birds to Use One Horsepower

Wild Geese ..	346 lb.	101 sq. ft.	0.27 sq. ft. per lb.
Pigeons	83 lb.	58 sq. ft.	0.7 sq. ft. per lb.
Hu'ming Birds	15 lb.	26 sq. ft.	1.73 sq. ft. per lb.

By square feet is meant, *square feet of supporting surface.*

The best commercial monoplanes and biplanes early in 1922 did not carry in excess of twenty pounds per horsepower total weight, and the pay loads were near these figures:

Junker	3.54 lbs. per horsepower
Zeppelin Staaken ..	1.77 lbs. per horsepower
Bleriot Mammoth .	4.29 lbs. per horsepower
Fokker	4.77 lbs. per horsepower
Spad S-33	5.92 lbs. per horsepower

Aeroplane engines weigh from 1½ to more than 2 pounds per horsepower, and yet *two pounds of the muscles which move birds' wings give only a very small part of one horsepower.*

Aeroplane builders took the soaring or sailing bird for a model, but the flapping wing birds are far more economical in power expenditure. It is thought by many that in order to procure the same economy of power attributed to birds, it would be necessary to imitate every movement of the bird's wing, but in making machines to substitute the worth of the human hand (some far more complex than the flying machine we are thinking about), different movements are nearly always used to do the same work and it has been done faster and cheaper, too. Now the hand and arm perform more difficult and complicated movements than the wing of any bird.

For more than 25 years I have taken a deep interest in flying machines, having studied those that can fly to understand *why* they fly, and those that do not fly, to understand the reason for failure and to ascertain the good points in those failing to discover what features might be made use of. In 1919 I built a model flying machine on an entirely different principle from the aeroplane, which ran with a 2½ horsepower bicycle engine; it was geared back from the engine, but the engine was run up to its full speed. It is taken apart and is now in storage and I am anxious to build another as I now have more time, lighter materials and less to interfere with me while at work. I do not know of many men working on machines using this principle, but I am anxious to see some one build one well enough to show that it is far better than the aeroplane which has a propeller revolving cross-wise from the line of flight, giving a thrust of little more than three pounds per horsepower, with a great amount of wing surface that is a constant drag, that requires a specially prepared landing field and lands at a high rate of speed.

More people should study the flapping wing birds, swans, geese, ducks and many smaller birds, to appreciate the long distances they travel in a short time without depending on air currents.

It has been said that the reason birds fly with so little power is because they are so small, but study the figures given above comparing them with those stated in Prof. S. P. Langley's book "The Greatest Flying Creature" and this "reason" does not hold true.

The smaller the bird the greater the loss of power, and the more surface per pound required for its support. The swan weighs as much as 28 pounds and carries this weight far and fast on wings that are small for its weight. This is not done by any trick, but by a scientific principle of getting a fulcrum on the air, which is about 773 times lighter than water. The wing is a lever of the third class.

In making a machine to do the work of a hand or a wing or a leg, it is, of course, always better to use rotary motion rather than backward and forward motion in all parts that are suited to it and to use as few parts as will do the work in the right way with the least power.

It is important that our men of today use as a foundation the scientific knowledge that these pioneers have recorded in their books, and combine it with a knowledge of modern machinery and methods. It is not important to the world generally who hits upon the idea, but it is very important that some one does.

When the main principle of bird-flight is applied to transportation then civilization will take its next and greatest leap forward.

I wish to find others who are working along the same lines and would like to correspond with me.

Let each one do his own thinking and build his machine in his own way, but an exchange of ideas would be good, and if anyone is of the opinion that I may have stumbled on any little bit of knowledge in my reading that they have chanced to miss, let them write to me at 268 Willis Avenue, Bronx, New York City.

Hittle Tractor Hydro

THE Hittle tractor hydro record holder is of good design as its record of performance would indicate. Its record flight of 116 seconds has never been approached. The former record was only 29 seconds, making Mr. Hittle's flight all the more noteworthy.

Every possible method was used to cut down weight and resistance in every part of the model. This resulted in a total weight of only 1.75 ounce and an excellent glide of 8.75 to 1.

This model is a very stable flyer despite its light weight and large surface. It usually flies only 15 or 20 feet above the water but finishes up its flight with the motor practically all unwound.

Motor Base & Tail

A single white pine stick 5/16" deep and 45" long forms the motor-base. On the front the I. M. A. C. type of bearing for the propeller is bound and glued with a cellon base dope which is used on all joints. At the rear of the stick a piano wire hook for the rubber is attached.

The horizontal tail consists of a pie-shaped plane measuring 8" x 12" attached to the underside at the rear of the motor-base. The rudder, measuring 3½ to 3½ is attached at the rear of the rubber hook to the horizontal plane.

Wing

The wing is built of two white pine beams with ribs and tips of bamboo. A span of 43" and a chord of 5⅛" makes an area of 215 square inches. A slight dihedral is given the wing. The trailing edge is longer than the entering edge and the ribs are somewhat oblique in order to secure an even spacing.

The wing is fastened to the motor-base

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with two bamboo clips which permit of adjustment. The wing is set at an angle of 4 degrees with the line of thrust. The wing tips are curved up slightly at the rear.

Floats

Two neat floats which take practically the whole weight of the machine are situated directly under the wing, just far enough to the rear of the center of gravity so that the model will not tip backwards. A single float of triangular section is just behind the propeller. The floats of bamboo construction are fastened to the frame with streamline bamboo struts.

The weight of the floats and struts complete with struts is only .23 oz.

Power Plant

The four-bladed propeller has a diameter of 10" with a theoretical pitch of 14". Two two-bladed propellers carved alike from 5/8" thick planks are joined together. The blades are fairly narrow, tapering almost to a point at the tips.

Five strands of 3/16" flat rubber drive the propeller at about 760 R. P. M. when in flight. The rubber was only given 1500 turns when it made its record flight and was wound less on the other trials, showing it to be capable of even longer flights.

The Lathrop Tractor Model

LATHROP'S tractor has an official record of 240 seconds, which is the best performance ever officially made by a rubber-driven model in this country. On the record flight the model disappeared from sight at the end of four minutes and, from what the observers reported, it seems logical that the machine went much longer. It was never found, although the surrounding territory was carefully searched.

There is nothing in the details of the machine which needs a lengthy dicussion here as the drawings clearly show the general construction principles. There was one of the standard type of cans used on the machine attached at the center of the motor-base. Three strands of 3/16" flat rubber were used, giving the ten inch diameter twelve-inch pitch propellers a 90 second motor run. This run was sufficient to make the model climb out of sight on the several flights of the model before it was lost on the longest of all time. The motor base was about 3/8" high.

The total weight of this wonderful model was 1 1/8 ounces complete. Though this was a wonderful model it is *not impossible* to make one that will beat it! Mr. Lathrop worked long and hard on models before receiving the reward but it is some reward—the longest officially timed duration flight of any model aeroplane ever flown anywhere in the whole world and, for all the witnesses of the flight know, it may still be going!

Cook 45 Riser

THE Cook 45 riser is of the twin propeller, pusher type. The two propellers are 12 inches in diameter, carved from blanks 3/4 inch thick. They are alike except that they are cut to turn in opposite directions, both revolving outward from the center on top. The blades have a width of 1" and are 1/16" thick. They are sandpapered, varnished, and finally balanced in order to ensure smooth running. Shafts of No. 16 piano wire are fastened in each and bent in a hook to receive the rubber.

The frame holding the rubber is made of two white pine strips 39" long and 3/8" x 1/8" in cross section. In the front they are tapered, glued and bound with silk thread. A piece of No. 16 piano wire is bent to form two hooks for the rubber, and is bound on. These strips are separated by two "X's" and a straight piece of bamboo 3/16" x 1/16" in cross section, bound on with thread. The brackets for the propellers are made from No. 12 wire flattened and drilled for the shafts, glued and bound to the strips. Small copper or brass washers are used to reduce the friction.

The front plane measures 14" x 3 1/2" and is made of 1/16" round bamboo. The three ribs are given the curvature of about 3/16" by bending the bamboo over a flame; any low flame such as a candle being satisfatory for this. The rear wing is surfaced on both top and bottom. The two wing spars are 3/16" x 1/16" set with the small edge up. They run the full length of the wing. The ribs are 1/16" x 1/8", double, one on top and one below for each complete rib. The edges are of 1/16" square bamboo. The wing is covered on top and bottom with tissue paper. After covering the paper is treated with banana oil to shrink it.

The landing gear is made of No. 16 piano wire bent to the shape shown in the drawings. The wheels are cork, carved with a razor blade. They have a small piece of brass tubing for the axle bushing. All joints are soldered. The rear skid is also made of piano wire bent to shape and soldered.

One and one-half ounces of strip rubber is divided between the two motors and is hung loosely between the two hooks. In emergency, if strip rubber is not obtainable, long narrow rubber bands looped together will do the work. In the front end the rubber should be attached to "S" hooks which permit it to be detached and wound up with a converted eggbeater. When winding the rubber up, it should be stretched to 2 1/2 or 3 times its normal length and then gradually shortened as it is wound. In this way many more winds can be safely given to the rubber.

Pond Indoor Model

THE Pond indoor model is a very slow and consistent flyer. At a contest in which this model made the flight of 170 seconds, the other two official flights were 160 and 164.6. making the average 30 seconds more than the former indoor world's record.

The builder of this model examined all of the available models around and selected parts on one and parts on another to copy for the present model. The best parts from each model were used. The resulting model won for the constructor a pair of racing ice skates.

Frame

The frame of the model is of balso wood. The front of the stick is strengthened by a protective coating of Ambroid, about 3/4 of an inch back from the nose. This prevents the soft balso wood from being chipped and broken at the part of the motor-base which is most likely to be broken.

The "cans" and tail-pieces are fastened to the motor-base by means of Ambroid cement. No experience of parts so fastened of coming loose was encountered.

The frame barely stands the strain put on it. Two strands of 1/8" flat rubber are used. This amount of rubber with a little slack was wound 1125 turns on the record flight.

Propeller

The 12" oar used on this machine is also of balsa wood. It is very thin. The shaft was secured in place by a drop of Ambroid on both sides of the propeller. The tips of the propeller are rounded only slightly, as shown in the drawing.

Wings

The wing is of bamboo construction. The ribs, beams and tips are fastened together by butt joints, with Ambroid cement. The wing is not very flexible in flight, but it is very flexible to handle. The incidence of the wing is adjustable to some extent by a fairly deep "can" at the rear of the wing.

The tail-plane at the rear of the motor-base has two degrees of negative-incidence, which, with the bend in the motor-base, gives the model a rapid climb. The paper on the wing and tail surfaces is not doped. The wing tips are rounded to prevent the twisting of the wing due to any uneven pulling of the paper.

The tissue paper was selected from about about 20 sheets for light weight.

Weights

The total weight of this machine is .19 (nineteen hundredths) of one ounce. The weight is distributed as follows: Rubber motor .06; motor-base .05; propeller .03; wing .05 of an ounce.

The total area of the wing is 62 square inches. The loading per square foot is $144/62 \times 19/100 = .441$ ounces per square foot. With such a large wing and so little rubber, the speed of the model is just about the rate a person normally walks.

The skid shown in the drawing in dotted lines is one suitable for using in case an R. O. G. machine is desired.

Pond Tractor Model

THE tractor distance model designed by Bertram Pond is of standard design, with the exception of the hollow

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spar motor-base used. The record flight of 2,465 feet, accomplished on an unfavorable day, makes Mr. Pond's flight more noteworthy.

Even on a day when snow was on the ground a flight of 1,565 feet was made.

It is the light yet sturdy construction of the model which makes it independent of weather conditions. The total weight with six strands of 3/16" flat rubber is 1.47 oz. The glide ratio with the propeller off (but with the rubber on) is six to one.

Motor Base and Tail

A channeled spar with walls .025" to .028" thick with a cap of the same thickness glued on to it, forms the body of this machine. The stick is 3/16" x 7/16" in cross section and 33¼" long. (See detail drawing in the June 19th issue of AERIAL AGE). The channel was gouged out with hand tools and sandpapered to size, which was held to limits by the use of a micrometer. The cap was planed on a piece of plate glass for flatness, using a very thin cut. The cap was glued on with LePage's glue after the inside had been doped with banana oil.

The usual hook and bearing are fastened to the front and rear by Ambroid. Two 7/16" opening "cans" are used to prevent the motor-base from buckling.

The horizontal tail is formed of two bamboo strips with a split silk thread edging. The vertical member fits in the hollow of the spar, and it is of a shape to prevent warping.

The weight of the motor-base complete with fin is .35 ounce.

Wings

The wing is built up in the standard way with round tips to prevent warping. To counteract the efficiency loss accompanying a large dihedral or the loss of stability when the center of thrust is above the center of pressure (due to the depth of the motor spark) the front wing spar has a decided offset downwards sufficient to make the proper incidence and dihedral with both wing beams flat on the motor base. Also the center of pressure is raised without increasing the dihedral. The right side of the wing has more incidence than the left to take care of the torque of the propeller. The clips which hold the wing to the motor-base weigh .27 ounce.

Power Plant

The large 15" diameter 19½" pitch propeller is driven by six strands of rubber weighing .7 ounce. Propeller weight .15 ounce.

The rubber was given 825 winds on the record flight but will stand 1,200 as was proven later.

This model holds the unofficial Hand-Launched Distance and Duration Records with 6,300 feet and 522 seconds to its credit. It is a consistent flyer, having made 9 or 10 flights all over 1,500 feet. It usually climbs to a good altitude finishing up the flight in a very long but apparently steep glide, with the motor all unwound.

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FLIGHT ASSOCIATION OF OTTAWA, CAN.
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117 Albert Street, Ottawa, Canada

(*Concluded from page* 399)

second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after a delay of one hour. Any plane having once started cannot receive another start; however, it may complete the race, though forced down, provided it can do so before 5 p. m.

4. THE FINISH:

The finishing time will be taken when each plane crosses the finish line between the marks indicating this line, after having completed the full course, approximately 240 miles.

5. WINNER:

The winner of first place in the race proper shall be the pilot who has completed the full course in the shortest elapsed time, and second place the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS:

All pilots must hold an Aviator's license issued by the Federation Aeronautique Internationale and duly entered upon the Competitor's Register of the Aero Club of America.

7. RULES OF THE RACE:

(*a*) Pilots must hold a straight course after starting until they have gone the distance to be specified and marked.

(*b*) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with a faster overtaking plane.

(*c*) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(*d*) Pilots shall pass all turning points in plain view of the observing officials stationed at each turning point and at an altitude of not over 500 feet.

(*e*) After crossing the finishing line, all planes shall continue on their course until they have attained the altitude of 2,000 feet, then they may turn and return to the Field, and land in that part of the Field assigned for landing and in so doing shall not cross the course or finish line.

Any contestant breaking any of the foregoing rules of the course, or subsequent ones which may be officially announced in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS:

No protest shall be considered unless presented in writing to the Contest Committee of the Detroit Aviation Society, Inc., within twenty-four hours after the finish of the race.

9. NUMBERS:

Each aeroplane shall have a number assigned to it by the Contest Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over 12 inches in height.

10. No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.

Event No. 5

Pulitzer Trophy, Saturday, September 16. Cash prizes: First prize, $1,200; second prize, $600; third prize, $200. Free-for-all race for high-speed aeroplanes.

1. CONDITIONS OF CONTEST:

(*a*) Factor of safety—Monoplanes, 7½ as loaded for start of race; biplanes, 6 as loaded for start of race.

(*b*) Air speed greater than 140 miles per hour, as loaded for start of race.

(*c*) Landing speed not to exceed 75 miles per hour in still air. (See foot note).

(*d*) Visibility and maneuverability (land and air) which, in opinion of Contest Committee, is not a menace to the other contestants or spectators.

2. DISTANCE:

Approximately 160 miles, four times around a closed course of 40 miles, starting at Selfridge Field, thence west to captive balloon, thence to Packard Field and return to Selfridge Field.

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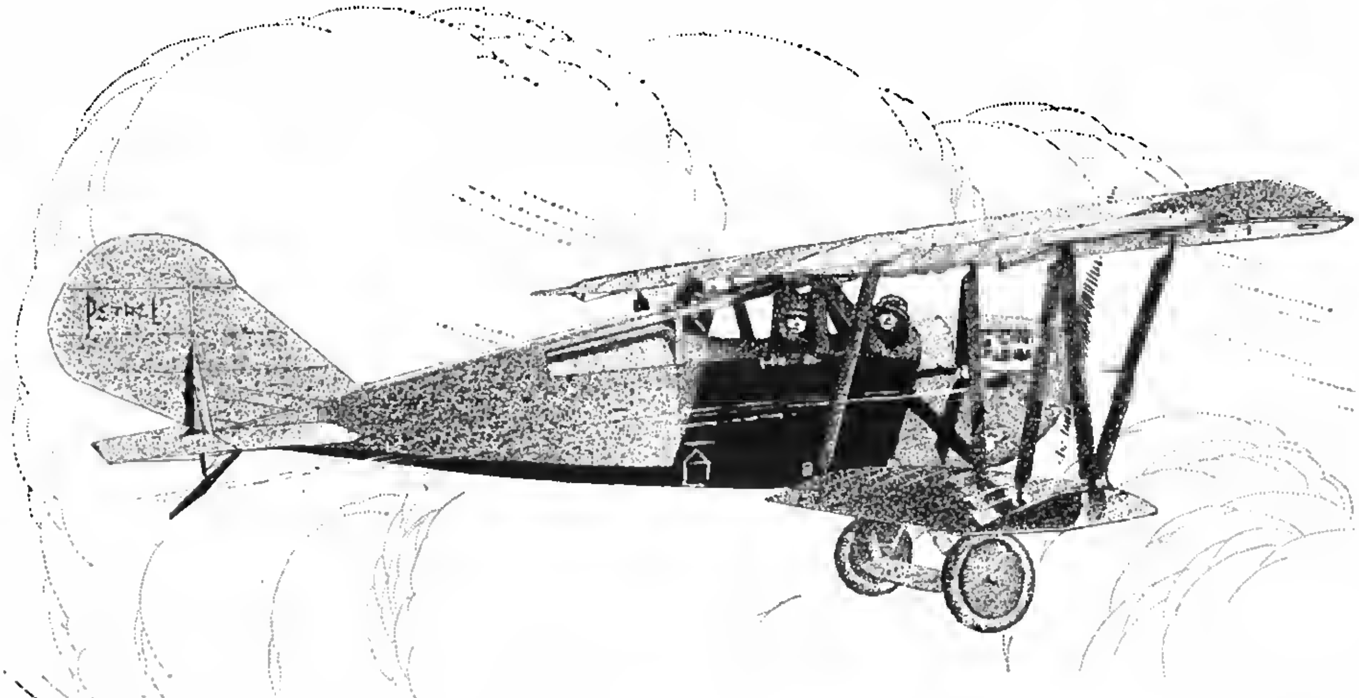

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Needless to say, however, the "Petrel," as well as all our products, is completely protected from the weather with Valspar and Valspar Enamels, to which we attribute to a large extent the highly gratifying results obtained.

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Photograph shows a stock model Huff Daland plane on the frozen St. Lawrence River last winter. With its surfaces protected by Valspar, it is proof against ice and snow, sun and rain.

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	(or D-5000 Plain Mahogany) OXX	27.00
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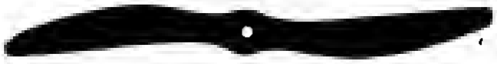

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(*Continued from page* 408)

board of which General Shanks is president. Representations of the need of relief having been made by General Patrick, chief of the air service, it is hoped that some remedy will be recommended from that quarter requiring, of course, legislation. What this will be is not made known, but it is presumed that some plan will be adopted to place the air service personnel on a separate promotion list, after the manner of the medical corps, with possibly, promotion by length of service, although that is not essential, provided the advancement is made equitable as vacancies occur with the fair distribution of original air service officers to the field grades, from which they are now hopelessly excluded, or that the younger officers will be distributed on the present promotion list more equitably according to their actual length of service. This separation of air service officers from the promotion list would not, it is pointed out, interfere in the least with advancement in other hranches, excepting in so far as such officers would benefit from air service vacancies. It would be justified, it is urged, by the fact that the casualties are so prevalent in time of peace. It is expected that same important announcement of interest and importance to air service officers will be shortly forthcoming in the report of the board engaged in a study of the promotion list. The impression prevails that, if the War Department approves of any recommendation of this character, there will be no difficulty in obtaining the necessary helpful and corrective legislation from Congress. A striking illustration of the disadvantage under which the air service is placed is afforded by the fact that of the officers now eligible for promotion in the various grades there are no air service officers among the 24 lieutenant-colonels, only one (Foulois) among the 30 majors, only one (Houghton) among the 67 captains, and 24 among the 152 first lieutenants. It is interesting to note that practically all of the 24 officers who are eligible for advancement from first lieutenant to captain are those who were originally commissioned as ground officers or transferred into the air service from other arms in which they were initially commissioned, this being due to the fact that the bulk of all the original flying officers are still a considerable distance from the junior officers in the list of first lieutenants for whom there are vacancies in the grade of captain.—*Army and Navy Register.*

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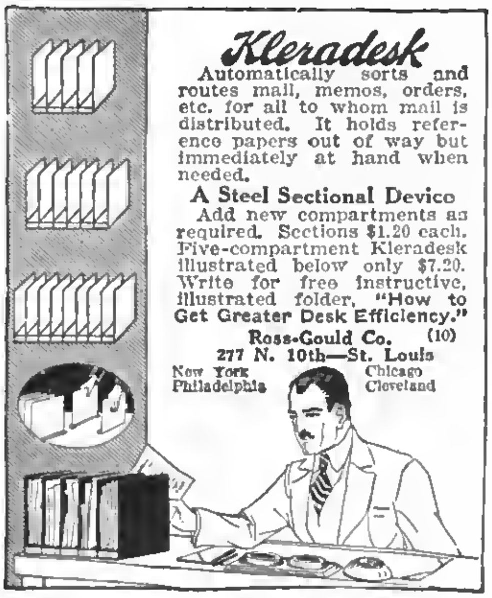

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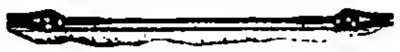

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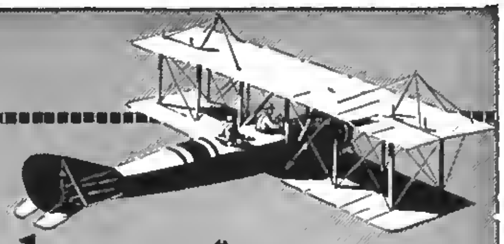

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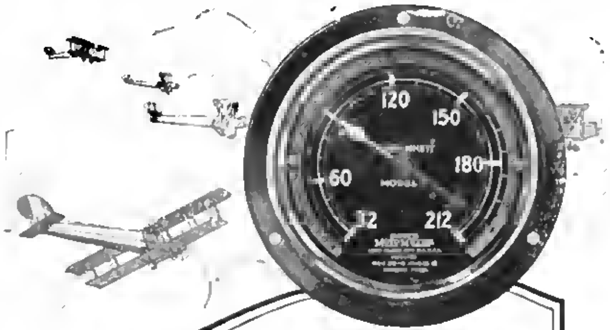

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Commercial Aviation Ready for Its Broadcast

Vital Importance of the Detroit Races

The Aeronautic Situation in Germany

American Engine Sets World's Record

European Air Travel in 1922

BUILDING OUR CITIES IN THE COUNTRY

A FORWARD LOOKING ARTICLE, INDICATING THAT THE TIME WILL SOON BE WITH US WHEN AERIAL COMMUTING IS COMMONPLACE

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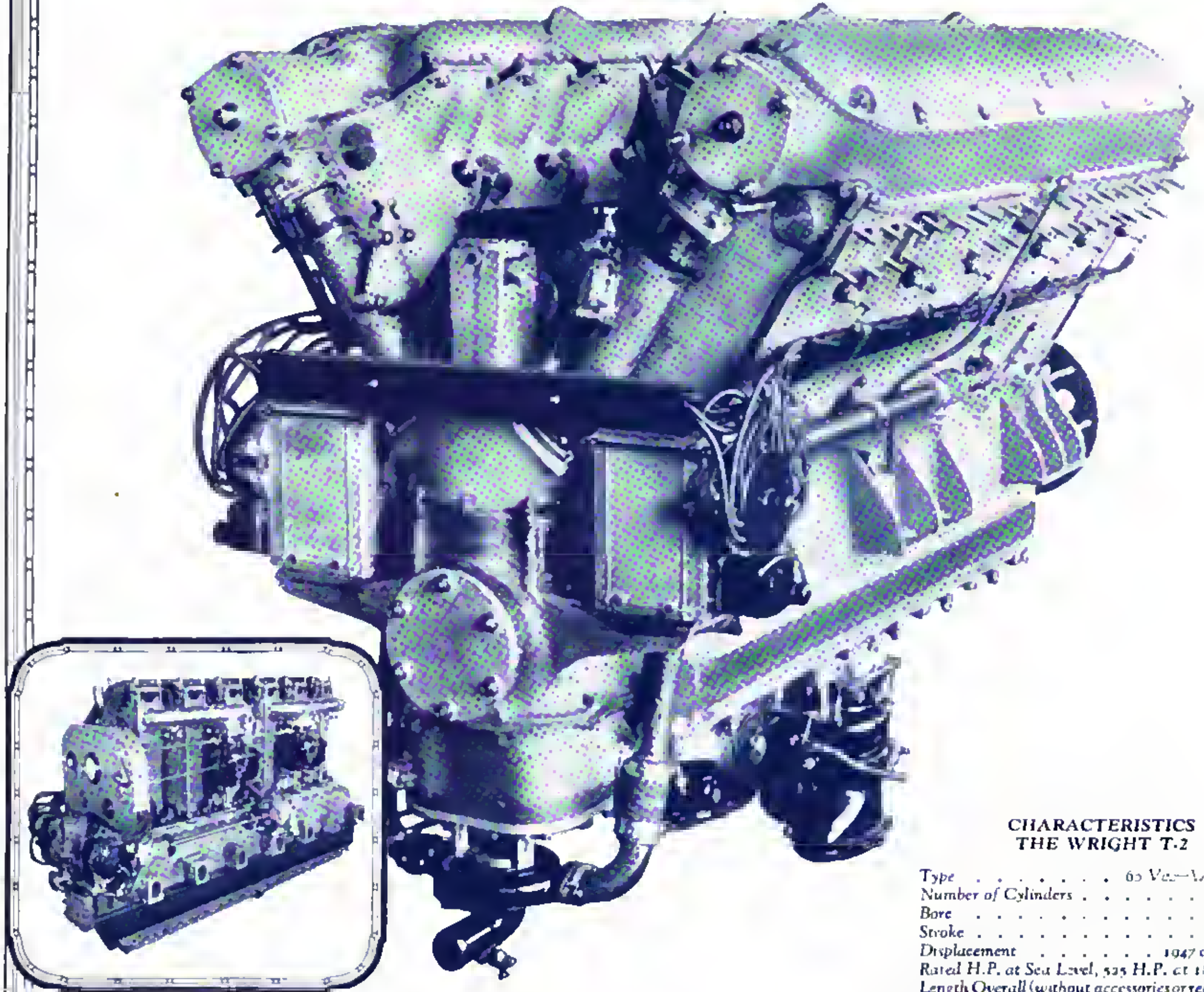

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Type	*60 Vee—Water cooled*
Number of Cylinders	*Twelve*
Bore	*5.75 inches*
Stroke	*6.25 inches*
Displacement	*1947 cubic inches*
Rated H.P. at Sea Level,	*525 H.P. at 1800 R.P.M.*
Length Overall (without accessories or rear)	*56¼ in.*
Width Overall	*31¾ inches*
Height Overall (engine bearer to top),	*24⅛ inches*
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TABLE OF CONTENTS

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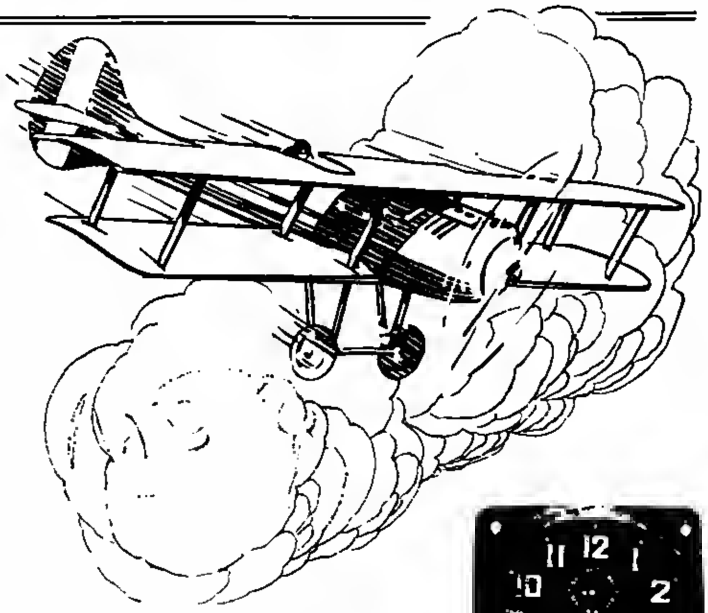
AND 1923 will find the demand accentuated. So say the men in closest touch with present developments. Aviation, as a business, is coming into its own with strides that rival the famed seven-league boots; and the man who prepares today for tomorrow's profits in air transportation will reap the sure reward for his foresight.



You Can Be a Pilot

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2.—These planes can be bought virtually *at your own price.* Sale is by sealed bids to be opened
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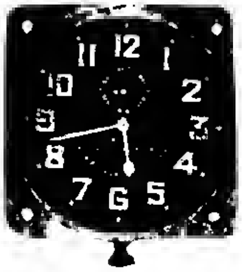

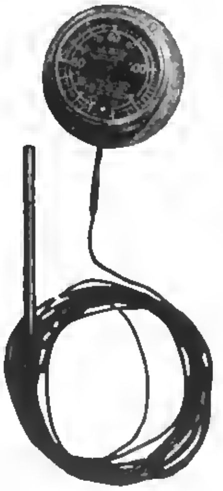

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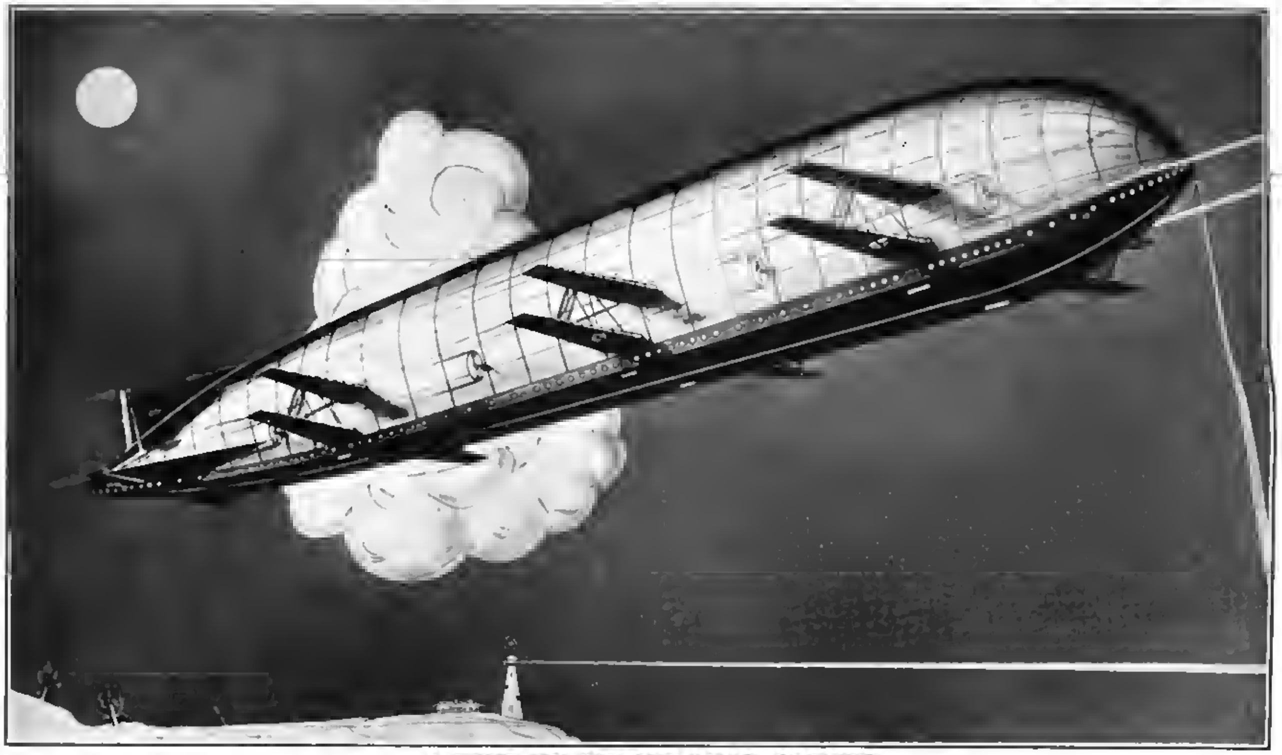

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A Squadron of Navy Scouting Planes, each of which is equipped with radio, by means of which they can maintain constant communication with the battleships

Commercial Aviation Ready For Its Broadcast

By John Walker Harrington

THE era of air travel is close at hand. Its coming is foretold not so much in words, as between the lines of that comprehensive review of the progress of aviation in 1921, just issued under the auspices of the Aeronautical Chamber of Commerce. Indeed, the very existence of such a body as the Chamber is an augury that the flying art is ready to sweep over the Rubicon and make good its complete conquest of the air. The Year Book for 1922 furnishes facts and figures in which all of us may read the bright hopes of the future. What will be the magic word which will bring aviation into its appointed place? How shall it find, especially in these United States of America, that definite urge, equivalent to the establishment of broadcasting stations which transformed radio from the fad of the few into the marvel for the millions?

As was the case with wireless telephony, commercial or civilian aviation needs most of all the establishment of focal points throughout the country and the cooperation of government. Whether or not it would be helped by a subsidy is a moot question, but there can be no doubt that the aid of all authorities, Federal, state, and local would give to the art an impetus which would soon carry it into the landing fields of popular approval.

Aviation just now is at the point in the United States which was attained by steamboating just about a century ago. The wiseacres of 1822 were becoming convinced that although God had given a grade to the rivers which made them flow down hill, that it was not flying in the face of Providence for man to make a craft which would go against the current. Many feared to commit their lives to the new fangled craft but there were plenty of venturesome souls willing to take the chance. Then came the railroads, built in the face of great opposition, for there were those who thought anything faster than the trot of a horse was harmful to the constitution.

That the public has confidence in the skill of authorized air pilots in this country is revealed by the report that in 1921 there were carried 122,512 passengers by commercial aircraft, as compared with the 115,163 who availed themselves of aerial transport in the previous year. The mileage flown, as officially recorded was 2,907,245, which indicates a very healthy state of the art, for although it is a trifle less than the 3,136,550 of 1920, it included less free and more paid flights. If the activities of those birds of passage, the gypsy fliers, are taken into the account, the actual number of passengers who took the air may have been about 250,000 or a quarter of a million. This would bring, as estimated in the Year Book, a total mileage of approximately 6,250,000 miles.

The gypsy flier is not so unmixed an evil as the gypsy moth. His zeal has done a great deal to advertise aviation to the American people. When he drops down from Nowhere and induces Squire Bill Jones to take a jaunt into the ether, he does put aviation on the map. If he brings the Squire back safe and sound, he induces all the leading citizens of the vicinage to take a flyer and makes cloud hopping the rage. It is a lamentable fact that most of the casualties of the last year were due to the aerial tramps and to the doers of stunts. There were no lives lost through the operations of the duly organized companies, whose machines were in charge of efficient and conservative pilots. There has been a surprisingly large amount of passenger traffic, despite the phobias and the misgivings promoted by the alarmist accounts of accidents printed in the popular press. Many thousands of persons are now traveling by the ethereal routes as a mater of course, and they have done a great deal toward hringing aviation into common use. In some regions, the aeroplanes are going and coming like taxi cabs.

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Private owners, such as Mr. Vincent Astor, use them as unconcernedly as though they were riding in their own automobiles. A group of friends of the young millionaire, the other day, made a flight from Port Washington to Newport in eighty minutes, and the newspaper accounts of the flight brought out the interesting circumstances of his own journeyings through the air to boat races and ball games. When the exact details of flights are more fully reported in the daily press, and the newsboys cease to cry "Turrible Accident" every time a pilot runs out of gasoline and has to volplane into a cornfield, the art of flying will be well on its way toward becoming one of our most popular outdoor sports.

What most is needed, in the opinion of those who would see the rapid advance of American aviation, is a through air route over which the public may be taken at night. Owing to the scarcity of terminals and the paucity of emergency landing fields, such a plan cannot be fully carried into execution. Suppose, though, that the trip could be made, as has been suggested, from New York to Chicago, without any overnight stops—one long and steady hop. When Mr, Robert Fulton took the first commercially successful steamboat up the Hudson, he had the Clermont tied up over night before the trip was much more than half done, for it would have seemed too much of a strain to have expected of a new mechanism, that it should go in the dark as well as in the light of the sun. When suitable lights and marks and fields can be made ready, however, there is every reason to believe that aviation will get much of that popular urge which is so necessary to putting it on a broad commercial basis.

The way certainly has been blazed for the art by President Harding by his advocacy of the Aerial Code, which will be a great encouragement to Civilian flying. The bill now pending before the House which would regulate the operation of aircraft in state and interstate commerce, and establish a Bureau of Civilian Aeronautics in the Department of Commerce will be an efficient guide to the new order. A huge aerial highway, like the Lincoln Highway of the land, over which could course the argosies of peace letting down their passengers as well as their "golden bales" would do much toward establishing air travel on a parity with vehicular transportation on the land. Just as the efforts to give to this country well ballasted and macadamized roads, has stimulated the production of automobiles, so the marking out of some great aerial trunk line, to be followed with ease and safety by night and day, will do much toward giving to aviation its popular broadcast.

Long distance aviation, although there have been some phenomenally sustained flights, is still young, for the 1922 Year Book tells us that the average duration of the 130,736 flights made in 1921 was only twenty-one minutes. There must have been some very short essays of the bright empyrean, indeed mere glimpses of cloudland, to bring down the average so low. The lack of facilities is a factor in this, for although there are 146 terminals now as compared with the 128 of 1920, air travel is still much handicapped for the lack of ports. When commercial aviation comes into its own, aircraft should be able to keep much busier.

The 1200 craft now in commission have made little more than a hundred and ten flights a year each although their number is twenty percent higher than that given in the 1920 census.

Passenger rates are coming down, by the way, as the average charge for the short flights in this country is now $9, whereas the 1920 rate was $12.50. The usual rate per mile charged for the inter-city flights is now 55 cents, a decrease of ten cents from the fare of the previous year.

Aside from the brief excursions skyward, commercial aviation even now is providing some well sustained travel programmes. The Aeromarine Company for the sum of $75, one way, transfers passengers from Key West to Havana or vice versa. The schedule provides for a flight of an hour and a quarter and, it is advertised, that the passengers save seven and a half hours, as compared with the length of time which would be required on the water trip. The same company has also been successfully operating a line of aeroplanes between New York and Atlantic City.

The Curtiss Northwest Aeroplane Company is running its aerial cruisers from time to time from various points to Minneapolis and St. Paul. Out on the Pacific Coast Walter T. Varney is furnishing air transit to the California sightseers.

One of the most significant developments of commercial aviation is the transportation of both freight

G. Elias & Bros. Commercial Type Aeroplane, built in Buffalo, N. Y.

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Jackson Park Yacht Club, Chicago, Ill. Photographed from a Ralph C. Diggins plane

and passengers in Larsen monoplanes from Edmonton into the Canadian oilfields. Prospectors and promoters save many days by this course, as they otherwise would have a long and tedious way by land and water. The Larsen interests have been doing a remarkable service all over the United States in giving educational flights and in converting thousands of persons to the higher life.

The epigram that the automobile industry is merely an infant, and that commercial aviation is unborn, is hardly justified by such records as are here cited. If civilian air travel is still to see the light, it is certainly a very live and kicking embryo, and even now it compares favorably in many ways with similar flying in Europe.

What with government aid, and the earnest cooperation of the large manufacturers, which is still more important, perhaps, European public flying is so far advanced that the air excursions are referred to as ordinary methods of transportation for tourists. Americans returning to this country start a thrill or so, by telling of their adventure in crossing the English Channel on their way from London to Paris, but Englishmen and Frenchmen regard all such expeditions as part of life. Dining at sunset at the Savoy and supping at the Ritz are pastimes for romantic bridal couples, and before long they will be undertaken in staid and sober fashion by other "respectable married people with umbrellas," as Stevenson used to say of the volcano visitors.

French commercial aviation is certainly proceeding apace, for the cables bring the news that this last June from the le Bouget air port in Paris alone, 544 planes arrived or departed. They transported in that period 2,058 passengers, 56,360 kilograms (about 120,000 pounds) of merchandise, and 472 kilograms of postal matter.

British commercial aviation has also been on the quivive, for it is reported that up to September of last year 671 planes had been in commission going and coming from the Continent with 4,006 passengers. In England there were 31,853 passengers carried.

The business of transportation of freight and express matter is well under way on the other side of the Atlantic, for England sent away air exports valued at 110,400 pounds, while her imports from beyond the choppy channel were 206.357 pounds. Costly hats, rich perfumes, small works of art, notably Chinese porcelains and Old Masters, are often sent from Paris to London by air.

Germany for many years has had established air transportation facilities and now has ten aerial trunk routes. Flyings beyond the Rhine proceed in regular schedule and passengers and freight are conveyed quickly from place to place.

Although the layman does not yet realize it, there has already developed in this country something of an "Overland" freight service. The editor of the Year Book tells us that American aircraft in 1921 carried 123,227 pounds of goods, or about three times the amount transported by air in 1920, which was 41,390 pounds. Much of this merchandise, it is true, was carried for advertising purposes or for the introduction of products. In a practical way and as a matter of routine, however, many large wholesale drug houses are shipping valuable medicines, such as toxins, in this way, while silk dealers and jewelers often resort to the air routes for quick delivery of their wares. In regions where civilization is not always on guard, such as

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among the gold and oil prospectors, there is a dearth of soap which is often met by the speedy aeroplane.

The managers of the large express companies in the United States have already put themselves on record as favoring the carrying of packages of value by aerial routes. They believe that the development of the Air Mail Service of the United States, which is doing well despite many drawbacks, will bring about a steady demand for transportation of compact and valuable goods "via Cloudland." The details of aerial freight transport are being worked out so closely these days that it will only be a quesion of time before railroad and express companies will recognize in aircraft companies formidable competitors.

The flying machine may be made to serve the financial interests in all directions, especially in the transportation of checks, drafts, and other business papers, and thus it will become the ally of the Clearing House and the Federal Reserve Bank. Finance and commerce are vitalized by dispatch and they are willing to pay the cost of creating it. Commercial aviation will ascend still more toward the star of success, as its appliances are more and more adapted for the traffics and discoveries of peace. Much genius and patience was devoted to the building of planes for war purposes. Lightness of construction and speed were important requirements in the conflict and the military aviator was not so much concerned about his own safety as the prospect of bringing down an enemy. The open cockpits and the long, low rakish bodies are essential to military operations, but now the trend is toward craft which will be comfortable for the passengers. Then will come the staid folks who won't even put on several thicknesses of jackets, and goggles, but will sit in the cabin behind the mica windows, in ordinary attire and sip lemonades or anything else beyond the three-mile limit, and read the magazines while the world goes by underneath them. These passengers of the morrow must have all kinds of conveniences and they will forget about the risks, and only know where they are, probably when they feel the machinery throbbing only feebly and are aware of the downward drag.

There are the genius and the inventive skill in the United States which will make possible the building of aircraft which will meet every requirement as passenger carriers and cargo bearers. The difficulties of air travel, and for that matter, those of safely piloting the planes, have been much exaggerated. With a public which has a sportsmanlike quality and with cool and experienced pilots, the ordinary problems of aerial traffic can be readily solved.

Now is the time, then, for Congress to give the word to go ahead, by adopting without delay the Aerial Code. If this be followed by a consistent and aggressive policy of development in the naval and military aviation, and all efforts be used to make the Air Mail Service a notable success, commercial flying will win more and more of popular favor. What is needed at the present time is concentrated effort on the lines of demonstration. If the large aeroplane manufacturers will help in the worthy cause of spreading the gospel of safety by establishing or promoting through air routes, the public will have daily assurances that aviation is a sane and riskless pastime, within just the same limits, at least, as railroading and automobiling are not perilous. Foreign aircraft corporations have been so wise and far seeing as to aid in this policy, and thus cooperate with the various governments.

The speedy enactment of an Aerial Code by Congress would make possible a general national campaign in the interests of commercial aviation, as it would clear the air of many vexed problems. Then it would be possible to gain the full cooperation of the authorities, national, state and local, and of the manufacturers and various air transportation companies, in the development of air ports, terminals, emergency landing fields, and all those facilities needful for the symmetrical and orderly development of the Icarian art.

Vital Importance of the Detroit Races

By Harold E. Hartney

It was not many years ago that a small town in Ohio passed an ordinance prohibiting the railroads from laying tracks through the municipality. The village solons had decided that the railroads traveling at the inconceivable speed of fifteen miles an hour would be a menace to human life and property. Times have changed, to be sure. The Twentieth Century Limited and the highly developed motor car have accustomed us to forty, fifty and on occasion sixty miles an hour. For several years now it has been a fast life. But when the thousands gather at Detroit, Michigan, in October to witness the National Aeroplane Races they will, without question, see such speed as to convince them that another and superlatively fast era is dawning. As this is written there are more than fifty entries for the various events sponsored by the Detroit Aviation Society, which has been working for several months, actually working, to the end that this year's great races shall be known as the greatest flying meet ever held, in America or anywhere else.

On the last day of the races, which commence with the Curtiss Marine Trophy Race on October 7th, and conclude with the Pulitzer Trophy Race, the crowds will witness the most significant and vitally important contest ever staged on this hemisphere, and possibly, many believe, in Europe. There are twenty-three confirmed entries for the Pulitzer race alone and still others to come in before the list is closed. All the machines bear the technical description of pursuit planes. A majority vary in design, motor power and construction. Some are of metal, others of wood, and others of wood and fabric. Several will have 600 horsepower motors, Packard type, which General Mitchell recently pronounced one of the most efficient aeroplane engines yet developed. He added that if there had been any bugs in the Packard 600 (and no motor was ever produced that did not develop bugs in its initial stages), said bugs have been exterminated by the combined efforts of the Packard engineers and the scientists working with the U. S. Army Air Service. Great things are hoped for the Packard. Then there are the Curtiss and Wright motors, both of which possess excellent recrods for efficiency. The Curtiss and Wright motors showed their teeth at last year's Pulitzer; while the Packard, then in an experimental state, won out in the 1920 classic. The motor contest will be worth watching.

(*Concluded on page* 474)

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Building Our Cities in the Country

By R. R. Blythe, R. A. F.

COMMERCIAL aircraft in America traveled 6,500,000 miles during 1921. Six million miles in the air in one year! There can be drawn only one conclusion from this statement and that is that where we have now flown a distance sufficient to convince the public of practicability of aviation, the future lies ahead in an unlimited broad expanse of development.

Our national yearly average is something like 9,000 deaths in automobile accidents compared with only fifty-five deaths caused by aircraft. Yet the great majority of the American public today will point out that flying is unsafe. The reason of this lies directly in the fact that our newspapers have impressed upon the public at every opportunity by featuring aeroplane crashes that there is still a grave danger in flying.

Major B. L. Smith, general manager of the Aeromarine Airways, Inc., stated in his address before the Aeronautic Executives that the report in the Sunday newspapers of the crash of the London to Paris air liner decreased the gross income from passenger flights by 100 per cent over the previous Sunday's income.

Yet this great commercial air transportation company now operating in the United States has not had a fatal accident to a passenger on its flying boats in two years' flying history.

In fact, one of the most encouraging signs that the day of profitable and reliable air lines—linking our cities with scheduled passenger, freight and mail service—may not be far distant, is to be found in the report recently submitted to the Director of Naval Aviation by this company, owning the Aeromarine passenger planes. It operates a daily mail and passenger service between Key West and Havana, Cuba, according to the report; also between Miami, Fla., and Bimini, and between Miami and Key West. Its fleet consists of six eleven-passenger converted navy flying cruisers and six five-passenger flying boats. In addition to scheduled service, the company engages in special charter flights.

The Aeromarine flying boats made 735 complete flights, the report points out, in the four months from November 15, 1921, to March 15, 1922, with a record of 640 hours flown, and 268,538 passenger miles. Of these flights, 171 were on the 100-mile Key West-Havana route, while the charter and miscellaneous flights totaled 359.

During these operations, not a passenger nor employe was injured, and only five boats were forced to return to their bases. The schedules were maintained throughout, with the exception of these five flights, according to the report.

In two years of operation, the report discloses, the company's flying boats in passenger service have flown a distance of more than 150,000 miles, and have carried 10,700 passengers without a mishap.

Our own Air Mail carries its message of safety and reliability on all the trips started between New York and San Francisco for a period of six months there only developed one half of one per cent mechanical troubles that caused forced landings. During this period not a singe pilot was injured. Plane No. 189, which is in service between New York and Bellefonte, Pa., has been flown over four hundred hours, or about forty thousand miles and has not yet had a mechanical forced landing.

With these records of safe operation why does not the public utilize this mode of transportation which can carry passengers or freight in half the time consumed at the present time? The answer is apparent, though many have evaded facing the inevitable—the establishing of organized air ports sufficiently available from the centers of commerce.

The distance of these air depots from the centers of commerce is perhaps one of the greatest drawbacks to the development of commercial aviation. Considering New York as a point in question, it is safe to state that not over ten metropolitan mercantile companies have considered using aircraft for transport, and it is equally safe to assert that the inaccessibility of air ports the greatest factor.

Let us therefore consider a main Grand Central Air Terminal at Battery Park* in the Borough of Manhattan. Seaplanes running up to especially constructed docks taking on passengers and freight in comfort—the luxurious F-5-L converted Aeromarine Seaplanes with the splendor of comfort and security—embracing from the heart of New York City four or more scheduled flights per day to Atlantic City, Boston and neighboring seaport cities. Every hour large deeply upholstered D.H. 34's of latest type and construction, graceful Fokkers and Junkers monoplanes would take off across the landing field of Battery Park in regulated order, flying to all inland cities with burdens of passengers and freight. How long would it take for the most conservative firm to realize the possibilities of beating a competitor to a market in half the time that it would take a train to deliver the same goods? Bring aviation to the business centers and you've brought it to the hearts of the public.

Aeronautics will revolutionize the world. This change will not come about in a violent or sudden burst but slowly and steadily as the public realize the greatest of all modes of travel and its uses. All life has depended upon transportation; in the early days the settlers built their homes on the river banks; waterways, railroads and motor roads today form the arteries of all countries.

Many and manifold as are the advantages and attractions offered by the cities, numerous also are its disadvantages and hardships. We cannot look at a city today without seeing its slums and tenements as well as its parks and boulevards.

It goes without saying that thousands of city children grow to maturity under conditions that are as far from inspirational as are those that have hampered the natural development of many a country-bred boy and girl.

Our present system is not sufficiently flexible to meet satisfactorily the variable conditions presented by the human element. And therein lies the overwhelming disadvantage of the city. Expansion beyond a certain point results only in congestion, and this in its various phases lessens the values otherwise growing out of centralization.

In comparison with this we have in America great expanses of uninhabited land which is sufficiently adjacent to alleviate every crowded family in New York. Sweet fertile soil and clean, wholesome air and yet we are crowded to the close quarters of apartments with the noise and smoke, living and breathing, over three million people on Manhattan Island.

The city of the future will be like our congested business sections at night—useful only for centralizing our business efforts and segregating the contact from the home.

Commuting by air will bring in the millions for the day's work and will return them to the pleasant home with spacious ground, where the trout stream bubbles close by and in the early twilight the birds twitter each other to sleep. The commuting will be swift, clean and pleasant, instead of rushing like moles into the subways and trains, where the masses push and struggle, breathing the foul subterranean air in the mad rush of the eight forty-five and the five-fifteen.

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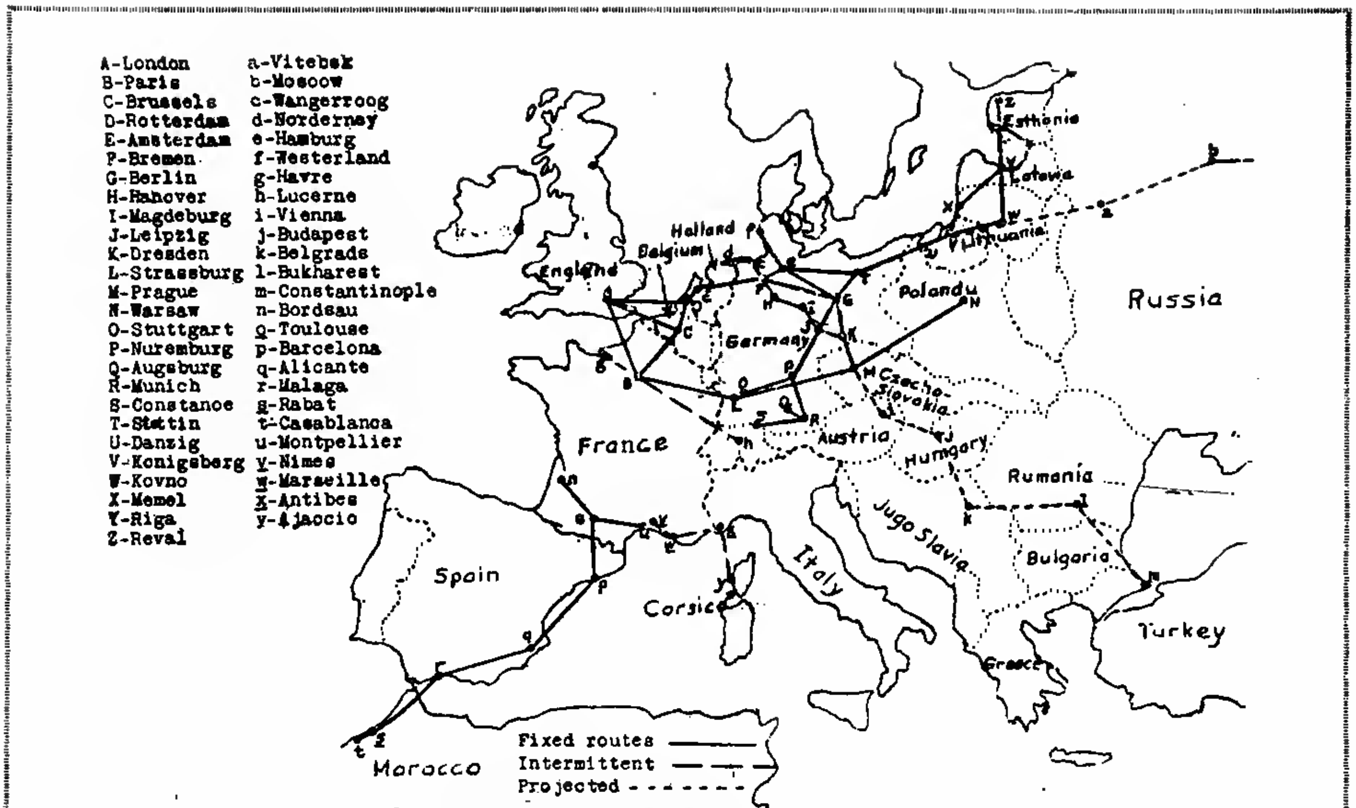

Existing and proposed passenger airplane routes in Europe.

European Air Travel in 1922

By Edward P. Warner*

OF that horde of American tourists that are already crowding every ship that swings down New York Harbor from the Battery or out past Boston Light, there are, no doubt, many who are planning, whether openly or secretly, to make for themselves a real trial of air transport before they return to the United States. The trip from London to Paris by air has become so much a commonplace that it is included in the itineraries of carefully shielded parties of schoolgirls, and one seldom hears danger offered as an excuse for not taking that journey at the present time. The expense is still the principal drawback to a more extended use of that and other air routes, and it is admitted by those connected with the administration of the air lines that a large part of the traffic is made up of American tourists.

The general scope of the routes is shown by the accompanying map, on which the designation "regularly operating" is used for lines running at least three times a week in each direction. The routes will be observed to fall into four general classes, those radiating from London, the lines of Southern France and the Iberian peninsula, those of Germany and northeastern Europe, and the French lines running to the east and northeast from Paris.

The failure to establish more extensive direct connection between the German and French lines is the outgrowth of political feeling and of the provisions of the International Air Navigation Convention, in accordance with which communication can only be made through neutral countries until such time as Germany shall be admitted to the League of Nations and allowed to ratify the convention. The failure to link up the lines of northern and southern France is a little more surprising, but can be attributed primarily to the excellence of the terrestrial transportation. A train leaving Paris a few minutes before 8 in the evening arrives at Toulouse at a few minutes after 8 in the morning, in plenty of time to connect with the departure of the aeroplane for northern Africa. It is not economically sound at the present time to attempt to run air lines over routes already well served by the railroads if the distance between the termini of the line is such as to make an easy night's journey by through train. From 300 to 600 miles is the worst possible distance for an overland air route, since that is the distance over which travel by night presents the greatest advantages.

Turning to the detail consideration of the routes shown on the map, there are five distinct companies operating between Paris and London, and some regularly scheduled journey over that route starts at nearly every hour during the day. The voyager has his choice of a large range of types of vehicles, ranging from the war machine rebuilt to carry four passengers up to the luxurious twin-engined commercial aeroplanes carrying 10 or more and used by several of the companies. The time required for the trip depends somewhat on the type of aeroplane used, but is normally from two and a half to three hours. Between London and Brussels and London and Amsterdam (with a stop at Rotterdam), also, there are daily services, the one to Holland being operated by a Dutch company with Fokker aeroplanes.

The second group of routes includes the comparatively short run from Bordeaux to Montpelier, with a stop at Toulouse, and the line from Toulouse to Casablanca, in French Morocco. The latter is now running five times a week and has been operating for two years without serious

* In the Christian Science Monitor.

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accident, although some parts of the territory flown over present great difficulties in case of a forced landing. The whole distance from Toulouse to Casablanca is covered in two short days' flying, an overnight stop being made at Alicante. The time from France to Morocco by air, even including the intervening night, is less than half that required by rail and boat. There are a couple of additional lines which are in intermittent operation in this territory, and those who wish to visit Corsica may be able to make arrangements for crossing from Antibes and Ajaccio by air if they date their trip properly.

The German lines and those running through northern Europe with Paris as a center, can be considered together, although the only actual point of connection between them is Amsterdam. The most important single route is that from Paris to Warsaw via Strassburg and Prague. The journey from France to Poland is being made in one day at present, having been changed from a two-day journey six weeks ago. The total elapsed time from Paris to Warsaw is 11 hours as against 40 by train, and the fare for the whole trip is only 800 francs, comparing favorably with the railroad rate by train de luxe with sleeper.

It will be noted that there is shown on the map as projected an extension of this line from Prague to Constantinople via Vienna, Budapest, Belgrade and Bucharest. It is the present expectation that this line will be operating regularly by the middle of July and it will therefore be available for the summer tourist traffic. The journey will probably be made in two days with an overnight stop at Budapest. The time by the Orient Express from Paris to Constantinople is about 110 hours, so that the saving in total elapsed time will again be more than one-half. When this line goes into effect, the principal cities of every large state in Europe except Bulgaria, Italy, Greece, Russia, and the countries on the Scandinavian and Iberian peninsulas will be connected by air.

Looking the other way from Paris, the line from Paris to Havre is seen to be marked as in intermittent operation, but aircraft meet all the large liners and the voyager can therefore transfer immediately from marine to aerial transport. If it is desired to visit Germany and northern Europe from Paris, the distance from Paris to Amsterdam can first be covered by air in four hours with stops at Brussels and Rotterdam. At Amsterdam one changes for a German-controlled line to Bremen, whence it is possible to fly directly to Hamburg, to Berlin or to Leipzig or various of the islands along the Frisian coast. The definite time-tables are not yet at hand this year for the German lines but it is probable that arrangements can be made by taking passage from London early in the morning to travel from London to Berlin in a single day.

Arriving at Berlin, further passage by regularly operated lines can be secured to any of the principal cities of the Baltic states as far north as Reval. There has been much discussion of a line to Moscow, but it does not appear to be in regular operation at present. The traveler wishing to visit Soviet Russia late in the coming summer, however, may safely plan on the basis of being able to make the trip from Paris or London entirely by air.

A number of the short lines in Germany have been omitted in this discussion. They are shown on the map, however, and almost all of those there indicated went into daily operation on the 15th of April.

As an indication of what can be done by air, a sample trip may be instanced. A voyager arriving at Havre can go from there to Paris, to Strassburg, to Stuttgart (this last short link by rail) and thence successively to Nuremburg, Leipzig, Berlin, Hamburg, Bremen, Amsterdam and London. The total distance traveled by air is about 1500 miles, while that by rail is less than 50. The journey could easily be made in five days or in four, if one were fortunate in making connections, and the total cost would be about $135.

Standardization and Aerodynamics

By Dr. A. F. Zahm

In Charge of Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. N.

WITH further reference to the article on "Standardization and Aerodynamics," published by William Knight in the AERIAL AGE of June 20, 1921, and the subsequent discussion in the AERIAL AGE of the suggestions therein contained, as contributed by Prof. Prandtl (October 3rd, 1921), Prof. von Karman (January 2nd, 1922), Col. Costanzi (February 20, 1922), W. Morgoulis (March 6th, 1922), Col. Verdnzio (April 3rd, 1922), Dr. Katzmayr (May 8th, 1922), Dr. Wolff (June 19th, 1922), regarding the comparison of methods of aerodynamic measurement and expression, I should say that it would now be opportune to have a representative committee appointed to formulate a program for such work.

The inclusion of a very great number of laboratories in the comparative tests does not seem advisable at the beginning. If a few of the foremost ones, testing not too difficult models, can obtain identical results, a good start will have been made. Such tests already are in progress in this country and elsewhere, but without a common plan of attack, and without a common formulated theory to furnish guidance and precaution.

The experimental program should be at least as comprehensive as the one proposed by Dr. E. B. Wolff, in the AERIAL AGE WEEKLY for June 19, 1922. An accurate exploration of the air stream, before the insertion of the model and during the test, should especially not be overlooked by the experimentalists. In two papers published by the National Advisory Committee for Aeronautics*, I emphasized this feature when the Committee was working on its program for comparative wind tunnel tests.

* Report No. 139, Influence of Model Surface and Air Flow texture on Resistance of Aerodynamic Bodies.
Note No. 23, Horizontal Buoyancy in Wind Tunnels.

The most direct way to study accurately and convincingly the correction to be made for Reynolds number vl/D, in applying model data to aircraft, would be to insert the full-scale craft in a wind tunnel of suitable size. A fully equipped aeroplane, for example, could easily be supported on a wire balance in such a tunnel, and given a comprehensive test when in natural working condition, including its power plant and observers.

Such a tunnel should have a throat measuring in cross-section rather more than 10 x 20 meters, and maintain a uniform air stream at 10 to 30 or more meters per second. The propulsive system required to maintain such a stream, at 100% efficiency, would be of slightly less than

(*Concluded on page* 474)

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Helium

By R. B. MOORE
Chief Chemist, Bureau of Mines

THE story of helium is one of the romances of science. Probably nothing, except perhaps radium, compares with it in human interest. Helium is one of the best examples of a discovery in pure science that has wide commercial application. In 1868, an eclipse of the sun was visible in India, several scientific men who were in India making observations of the eclipse turned a spectroscope for the first time on the solar chromosphere—that part of the atmosphere of the sun, about 10,000 miles deep, which merges into the corona. A bright yellow line was observed and was thought at first to be due to sodium. Janssen showed, however, that this line was not just the same as either D_1 or D_2 line of sodium, athough it was extremely close to these lines, hence he suggested that the new line have the designation D_3. Frankland and Lockyer decided that D_3 was due to an element in the sun not previously discovered on the earth, and suggested for it the name "Helium" from the Greek word "Helios" the sun.

For several years nothing more was done in connection with this element. In 1894, Sir William Ramsay, in conjunction with Lord Rayleigh, made his memorable discovery of argon in the atmosphere, which was announced at the British Association meeting in the same year. After this discovery, Ramsay looked for other sources of the element. Through Sir Henry Miers, he learned that Dr. W. F. Hillebrand, of the United States Geological Survey, had obtained an inert gas from certain uranium minerals, which gas he had decided was nitrogen. Ramsay believed that part of it might be argon; he obtained from Hillebrand for experimentation, a sample of the mineral, cleveite, one of the uranium minerals, and after extracting gas from the mineral and purifying it, he ran it into a spectrum tube. The lines obtained were, however, different from those of argon; among them was the bright yellow line noted by Janssen. Thus was terrestrial helium discovered.

Helium was found in the atmosphere, in the proportion of one part by volume in 185,000. From samples of air taken at an altitude of several miles and analyzed, the proportion of helium has proved to be about the same as at lower levels; at extremely high altitudes, such as 100 miles or more, the proportion may, however, be much increased. Helium is also found in very minute quantities in sea and river water; undoubtedly it exists in some of the fixed stars, as well as in the sun, and its presence has been spectroscopically determined in many nebulae. Helium is found in the gases evolved from many mineral springs; some contain a high percentage of helium, notably the gas from mineral springs at Mazieres, France, which has over 5 per cent of helium, and two springs at Santenay, France, with more than 8 per cent. But the total amount of these gases is relatively too small for extraction of helium from them to be feasible for practical uses. Helium is found also in some volcanic and fumarole gases, such as the steam issuing from the boracic acid fumaroles of Ladarello, Italy, which contains a small percentage; and in many rocks and minerals, being almost always associated with those of radioactive character. All thorium and uranium minerals contain helium in appreciable quantities; the gas can be obtained by heating the mineral strongly in a vacuum, or by dissolving it in acid. Some radioactive minerals yield from one to five cubic centimeters of helium per gram.

In 1907, Cady and McFarland, of the University of Kansas published a report on the presence of helium in several natural gases, mainly Kansas gases. Some of the samples tested ran as high as 1½ per cent of helium by volume. This work of Cady and McFarland disclosed the information necessary for the inauguration of the helium "project" during the war.

To date no one has succeeded in combining helium with any other element, or in inducing the gas to take part in any chemical reaction under any conditions. In this respect, it is similar to other rare gases of the atmosphere—neon, argon, krypton, and xenon. Helium is only slightly soluble in water. Its thermal conductivity is fairly high, but it is less than that of hydrogen. A volume of helium weighs about twice as much as an equal volume of hydrogen, under identical conditions of temperature and pressure. It is a good conductor of electricity, being next to neon in this respect. Under similar conditions it conducts a current 25 times as readily as air. After overcoming immense difficulties, Professor Kammerlingh Onnes, of the University of Leyden, in 1908, succeeded in liquiefying helium. The liquid boils at -268.75° centigrade or 4¼° absolute. Solid helium has not yet been obtained.

Before the World War, the Germans had developed a type of dirigible called Zeppelin, after Count Zeppelin, its inventor. In the early stages of the war, the Germans used dirigibles largely for bombing, particularly over London and the munitions district of England. Though minimized as long as the war was in progress, the damage done was great. Another use for dirigibles, recognized by military and naval men as probably more important than bombing is scouting. The German fleet never ventured from port without two or three scouting dirigibles which at all times informed the fleet below of the near approach of British war vessels. The German fleet could then accept battle, or retire to its base.

The French and British had no dirigibles at the beginning of the war, but later hastened to repair their deficiency. From experience gained in the defense of London and other important points, it was recognized that the dirigible was vulnerable—extremely so, against a well-organized attack. The Germans too recognized this and invariably made attacks on England at night, operating from a high altitude in order to minimize attacks by aeroplane, as a single incendiary bullet fired into a dirigible would quickly bring the huge ship down, a mass of flames. The inflammability of the hydrogen contained in the ship was the one weak point in this method of attack. The constant danger of a swift and terrible death had its effect moreover on the nerves of operating crews, lessening their efficiency. The remedy for this situation was, of course, to be found in a non-inflammable gas, light enough to replace hydrogen as a lifting force; helium is the only gas known to have these qualities. The use of helium has still other advantages: It diffuses through a fabric at about three-quarters the rate of hydrogen; its non-inflammability makes it possible to place the engines in the framework of the dirigible, thus getting a direct drive, giving greater control of the craft, and much increased speed for any given horsepower.

Early in 1915, word came to an official of the Bureau of Mines that the British were interested in sources of helium for use in dirigibles. When the United States entered the war in 1917, helium for use in dirigibles was discussed among Bureau of Mines' officials, and in June the matter was presented to the Army and Navy Air Services as a war project. These services enthusiastically approved the proposition, and allotments of money were made from the Army and Navy

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appropriations to carry it forward.

Three experimental plants were constructed in Texas, under the direction of the Bureau of Mines, two at Fort Worth, for economic reasons; one plant used the Linde system of liquefaction, the other the Claude system, and the supply of gas was piped to the plants from Petrolia, Texas. Analysis had showed that this gas contained .95% helium. Another plant was later constructed at Petrolia, near the gas wells, and use was made of a new method of liquefaction, called the Jefferies-Norton process. All three plants produced helium, but the Linde plant proved the most efficient, and it was decided to construct, under the cognizance of the Navy, a much enlarged plant for obtaining helium in greater quantities. The construction of this plant was started in October, 1918; it was completed in December, 1920, and was operated during part of 1921. It produced altogether about 2,000,000 cubic feet of helium, which, with the helium obtained at the smaller plants during the experimental period, makes available at the present time a total of about 2,400,000 cubic feet of helium over 90% in purity. Most of the gas is around 95% grade.

Before the completion of the large plant, the two experimental plants at Fort Worth were shut down and dismantled. The plant at Petrolia, Texas, was continued, however, until July, 1921, on a purely experimental basis. It was then shut down, and at the present time is being kept in a standby condition.

The method of operation in all of these plants is, in general, the same, although there is considerable difference in detail. The object is to liquefy all of the elements making up the natural gas except the helium, which does not liquefy at the temperature used. After liquefaction of all other constituents in the gas—such as nitrogen, methane, ethane, propane, and butane—the helium can be pumped off. Thus far, helium has been obtained in two stages. One stage in operation gives about 70% purity; this has been refined up to 95%. In the second operation the nitrogen, representing practically all the impurity, is liquefied and the helium is once more pumped off.

No production of helium is now in progress, but funds will probably be furnished by Congress to run the large plant at Forth Worth practically during the whole of next year. Under such conditions, from eight to ten million cubic feet of helium may be obtained.

Two helium repurification plants have been constructed by the Army, and the Bureau of Mines is cooperating in installing the final liquefaction equipment. One of these is at Langley Field, Va. In this is used an expansion engine refrigeration system, with heat interchanges, and an especially designed purifier. This plant will be used for refining helium after it has been used in a balloon or dirigible and has become contaminated with air by interchange through the fabric. When the grade of the gas is reduced to 85%, its lifting power (which is normally 92% that of hydrogen when both gases are 100% pure) is too low for practical use, and the gas must be refined. After being refined, it can be used again.

The other repurification unit has been installed on two railroads cars. One car contains the power plant, and the other the compressors and liquefaction equipment. These can be moved from place to place as needed. The use of charcoal at low temperatures for repurification will be tried in this plant. Charcoal exercises selective action in absorbing air and nitrogen, taking them up freely, whereas helium is scarcely absorbed at all. In this way a separation of helium can be obtained.

Complete equipment for conducting research at low temperatures, the Cryogenic Laboratory of the Bureau of Mines, is located at Washington in the Interior Department building, representing the research department of the whole helium project, and employing a force of 12 men. Fundamental information is being obtained that is essential for the construction of any new plant designed to have greater efficiency than the large plant at Forth Worth. Helium can probably be produced in this plant for 10c a cubic foot, but it is believed that the cost can, ultimately, he reduced to 3c and perhaps to 2c. Necessary information is being gradually accumulated to this end.

The Government's entire helium program is now carried on under the general authority of the Army and Navy Helium Board, consisting of a representative, each, of the Army and Navy, together with a delegate from the Bureau of Mines.—Reports of Investigations, U. S. Bureau of Mines.

New Navy Seaplane Engine

A MARKED feature of aeronautical engine development in this country is the encouragement by the Bureau of Aeronautics, Navy Department, of independent development of aircraft engines for the prospective requirements of naval flying.

An interesting result of this encouragement, is the development by the Wright Aeronautical Corporation, of a new 12-cylinder engine, known as Model "T-2." This engine was designed to meet the Navy Department requirements. and has been built on Navy Department orders. It is designed for heavy duty service sea planes, whose long flights require great durability, and on account of the weight of gasoline necessary, the engine had to be economical as possible. Notwithstanding these primary considerations, this engine, as developed, seems to have a wide range of application, owing to its low weight per horsepower.

Some of the "T-2's" mechanical features are believed to be entirely new. These include a form of crankcase, in which the crankshaft is held in the upper case by bearing caps, rather than by the upper and lower halves together; a form of can box, which not only carries the camshafts and rocker arms, but also forms a truss at the top of the cylinders. Integral with each cam box is an intake manifold, so designed that the carburetors may be placed either below the crankcase or in the V. An open end cylinder sleeve construction and the use of aluminum bronze valve seats are also new features. Refering to the photographs, we note that the cylinders are cast of aluminum in four blocks of three, and that a single cam box covers the six cylinders of each bank. In order to give the reader an idea of the size of this engine, it should be noted that it is slightly shorter than the Liberty, and fits into the same bed timbers. The details of the engine itself are as follows:

Bore, 5¾ ins.
Stroke, 6½ ins.
Piston Displacement 1947 cu. ins.
Rated H. P., 525 at 1800 R.P.M.

The engine is purposely somewhat throttled, in order to increase its ability to run for long periods, without decrease of power, and with a very low fuel consumption.

One of the interesting details of the engine is the cylinder construction. This permits of an aluminum combustion chamber in direct contact with the cooling water. A removable wearing surface is provided for the

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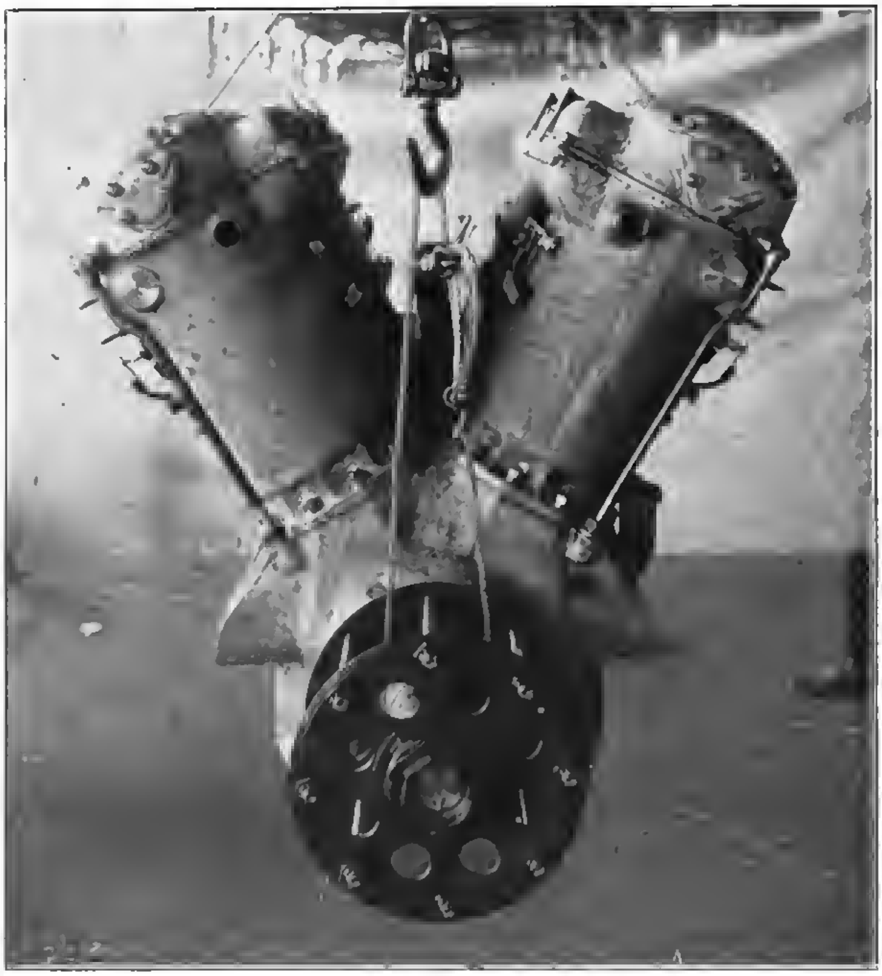
piston by the use of an open and steel sleeve, which is shrunk into the aluminum cylinder casting. The valves and spark plug bushings are seated in aluminum bronze rings shrunk into the cylinder heads. This construction provides for adequate cooling for both these important parts, and is considerably different from that used in the standard Wright engines heretofore, in which closed and steel cylinder sleeves were used. Four valves are used per cylinder. The valves are inclined at a small angle, and are actuated by rocker arms directly from a single camshaft housed in each cam box mentioned above. These rocker arms are carried on light steel tubes running parallel with the camshafts, which can be withdrawn from the end of the cam box, thus permitting the removal of the rocker arms. The lubrication of all of the valve-operating mechanism is effected by oil carried under pressure in the rocker arm tubes. Overflow pipes are provided to return the oil to the crankcase.

Valve adjustment is taken care of by adjustment screws on the rocker arms, and in order to facilitate this adjustment the cam box has a light two-part top, which can be easily removed, enabling a mechanic to adjust all valves and inspect the rocker arms, camshafts, bearings, etc. The design of the pistons present no radical features. Three compression rings above the pin and a scraper ring on the skirt are used. The floating type of piston pin, with bronze retaining plugs, is provided. The inner and outer connecting rods have a tubular cross section, the outer rod being forked to hold a new type of connecting rod bearing. This bearing is a split sleeve and is made of a new material, which does not require a babbitt facing. The inner connecting rod bears directly on the outside of this bearing, and the bearing itself bears on the crankpin. The crankshaft is exceptionally robust, having 3-inch diameter main and crankpin bearings. Seven main bearings are used, the center and front bearings being very long. The propeller thrust is taken by a deep row radial bearing. The propeller end of the shaft is interesting, as it embodies a new design of hub fastening. The shaft itself is splined with 17 splines. The drive is through the splines from the crankshaft to the propeller hub. The hub is centralized by a pair of tapered cones, one at each end of the splines.

Details of the crankcase are most interesting, as the design, which was first used in the Wright dirigible engine, provides an exceedingly neat and stiff girder for carrying the en-



Wright Seaplane Engine Model T-2

gine stresses. The method of construction might almost be called a one-piece crankcase, as the lower portion is only a bottom pan containing the sump and carrying the oil and water pumps. The main bearings are, as before stated, held in place by bearing caps. This method of construction makes it perfectly possible to remove the under pan, which contains no mechanism for which any readjustment is required, and thus inspect the main and the connecting rod bearings without removing the engine from the aeroplane.

The drives for the magnetos, camshafts, oil and water pumps, as well as the synchronizers, have been laid out with a special reference to accessibility and ease of adjustment. Not only are these drives arranged in a flat, compact form, as will be seen from the illustrations, but provision is made for a generator or fuel pump drive in the Vee, and a hand or electric starter, or other auxiliary, at the rear of the engine. Water is carried to the lower side of each bank of cylinders through suitable piping from the pump, and is taken out at the propeller end of each cylinder bank. The oil passes from the pressure pump through a large cylindrical strainer, and is fed to all parts of the engine under a pressure of 75 lbs. per sq. in., the only parts lubricated by splash being the pistons and wrist pins.

The ignition is by two SS-12 Splitdorf magnetos, one magneto firing all the inside plugs, and one the outside. Two separate carburetors, as seen in the illustration, are of the latest Stromberg aviation type. This engine, in accordance with the Navy Department's requirements, was built to run on standard domestic aviation gasoline. Furthermore, all parts, including spark plugs, crankcase bolts and oil strainer, are so placed as to be readily accessible and easily disassembled in the aeroplane.

The Model "T-2" engine, above described, has recently been accepted by the Navy Department, after an official 50-hour test, in which the engine developed an average of 500 h.p. at 1800 r.p.m. During this test the average fuel consumption was .48 lbs., and the average oil consumptoin .02 lbs. per b.h.p. hr.

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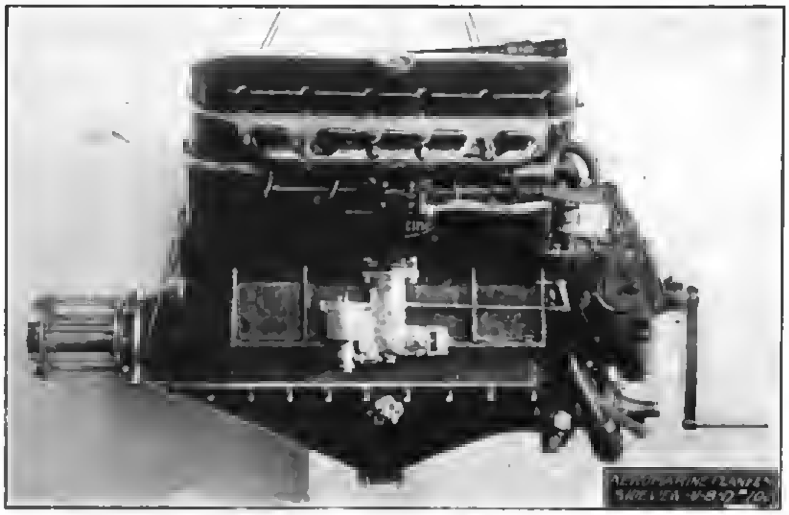
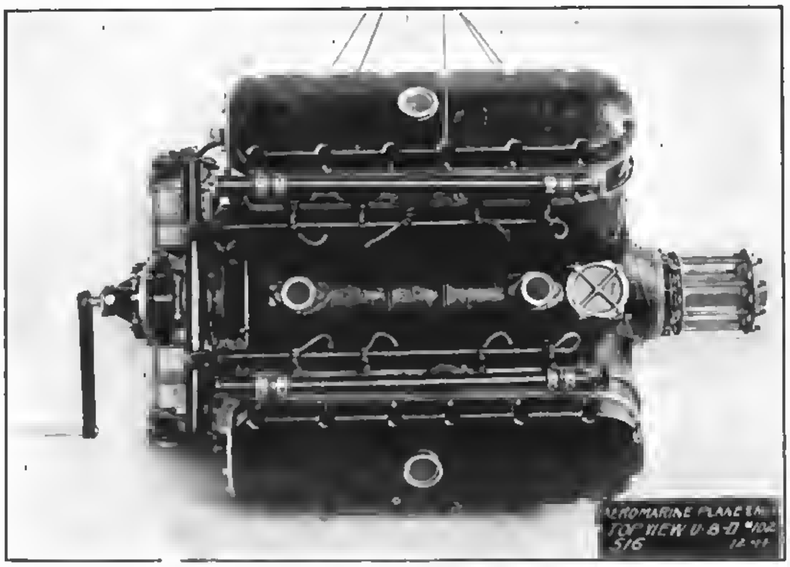
Aeromarine Aircraft Engine Sets World's Record In Endurance Test

THE Navy Department, Bureau of Aeronautics, have inaugurated new test conditions for aircraft engines which mark a new step in aviation development. In the past it has been the rule to prove new types of engines by a fifty-hour endurance test, run in five-hour periods. This test has generally been regarded as one of extreme severity and the few types that have successfully completed this period without major failures have been considered to have entirely proved their suitability for aircraft use. Realizing that the next step in aeronautics is the development of engines of greater durability, the Bureau has increased the length of their tests to six times the old standard, or three hundred hours. This ultimate limit was set in the expectation that any existing engine would have been run to destruction before that length of time, so that the actual life could be determined. The test, however, failed in its intention in the case of the Aeromarine U-8-D, which is still pulling its full horsepower and functioning perfectly in all respects at the end of the three hundred hours. Several engines have attempted this test, but as yet only the Aeromarine U-8-D has successfully completed the entire three hundred hours.



Side view Aeromarine U-8-D engine

The test is run in three main periods of one hundred hours, each including eighty-six hours at flying load, followed by fourteen hours at full throttle. After each hundred hours the engine was put through a complete series of tests to check up horsepower, fuel consumption, etc., and was subjected to detail examinations for wear. These tests were observed and all records checked and certified by Navy Inspectors working in three eight-hour shifts—to get in three hundred hours, working the standard forty-four hour week, would have taken almost seven weeks.



Top view Aeromarine U-8-D engine

The following facts are of interest and help towards a realization of the arduous conditions to which a test of this kind subjects the engine:

Each of the pistons as it reverses its direction of travel at the end of each stroke is brought to a stop, while at the middle of the stroke it is travelling at a rate of 38 miles an hour at 1700 revolutions per minute, rated engine speed. That is to say, in 1/112 of a second the piston speed is brought from zero to 38 miles an hour and is brought to zero again in the next 1/112 of a second. Each of the eight pistons continued these 112 accelerations per second for three hundred hours or 120,000,000 times. The explosion load on each piston is in excess of four tons and one hundred explosions occur per second.

The average horsepower developed was 175, which is sufficient to propel a five-passenger aeroplane at a speed of about eighty miles an hour and in the time of the test such a plane would have flown completely around the world.

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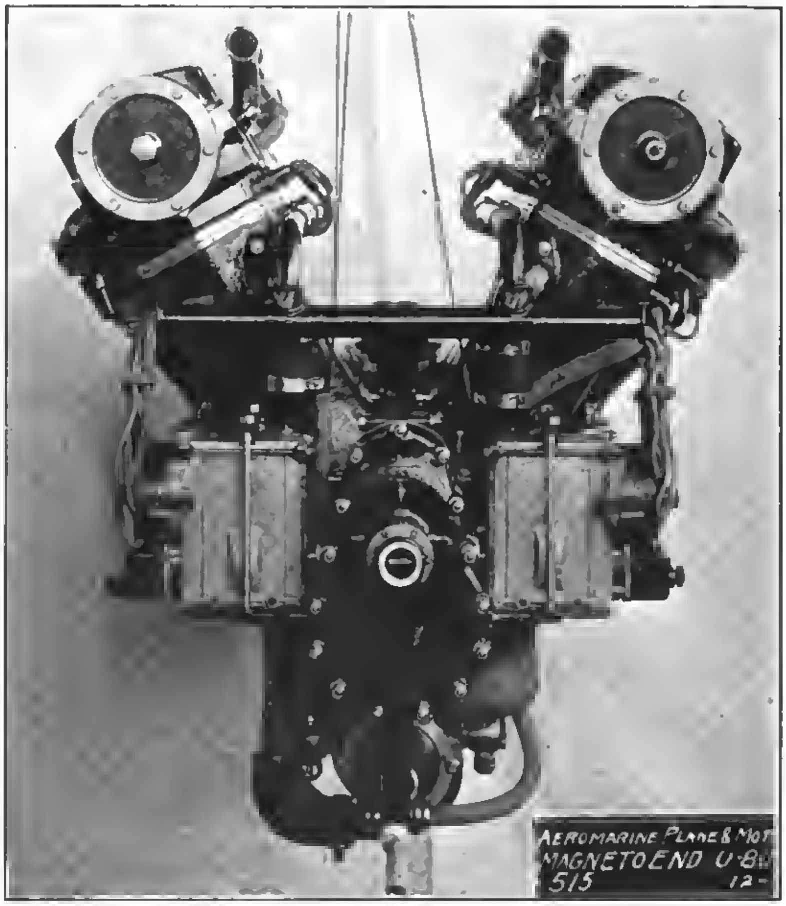


Anti-propeller end view Aeromarine U-8-D engine

The total amount of work done by the engine is equivalent to lifting a weight of one ton to a height of 1,270 miles.

Sixteen tons or 5,300 gallons of gasoline were used in this test.

The equivalent gasoline consumption in the plane would have been four and three-quarter miles per gallon. The average oil consumption was .0086.

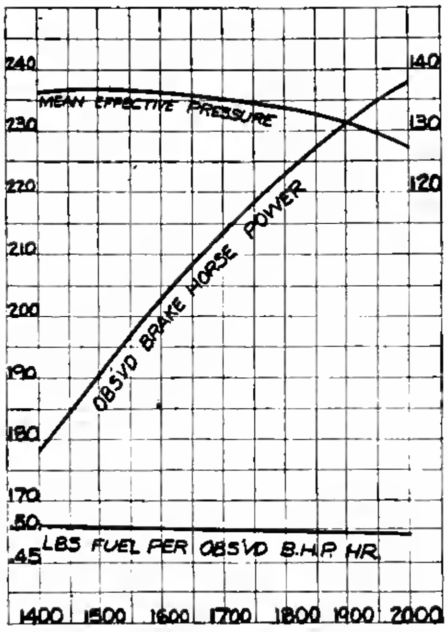
The tip of the propeller used on this test travelled 91,200 miles or almost one-third of the distance from the earth to the moon.

During the test the engine made over 31,000,000 revolutions and almost 9,000,000 revolutions between stops. As a comparison it may be stated that the ocean liners average about one-half million revolutions of the engines on the trip from Liverpool to New York.

During the test the pump on the engine circulated 2,726 tons of water.

The long valve life demonstrated in the test was deliberately aimed at, and very special attention was given to the valve seat and guide. The seat is cast into the head, which gives better thermal contact than any other known method of uniting two pieces.

The connecting rod bearings on the U-8-D have the same area as the 400 H.P. Liberty Engine, while the crankshaft bearings are considerably larger. Very special precautions are taken to insure extreme rigidity in the bearing shells and there is incorporated in the oil system mechanical means for trapping all the dirt in the oil before this reaches the bearings. This has resulted in exceptional bearing life.



Power curve of Aeromarine U-8-D engine after completing 300-hour test

The cylinder sleeves, which are removable for replacement, are in direct contact with the cooling water. These provisions together with the carefully developed water circulating system which concentrates the flow at the points where most needed, make the U-8-D Engine particularly insensible to water temperature conditions.

In order to keep vibration to a minimum the angle between the cylinders on the Aeromarine is made 60°. The 60° design gives a constant rotating out-of-balance force of exactly one-half the magnitude of the unbalance in a corresponding 90° engine.

The detachable head construction of the Aeromarine affords ideal accessibility for the complete valve mechanism. Heads can be changed in a few minutes, by which means a complete tope overhaul of the entire valve mechanism is effected, while necessary adjustments are made on the bench. The Aeromarine design affords quickly detachable and interchangeable cylinder sleeves.

For future production, modifications are being made to this engine whereby the weight is being very materially reduced on those parts which do not affect the life of the engine. At the same time the bore is being increased so that Type U-873 will be rated at 250 H.P. and in the high compression type will develop upwards of 275 H.P. The weight is 520 lbs., giving a weight factor of 1.9 lbs. per H.P. in this U-873 Type. This weight reduction is being achieved in spite of the fact that all parts which showed less than 100% perfect at the end of the 300 hours in the test are being strengthened or otherwise modified to bring them beyond the 300-hour standard.

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The M. I. T. Soaring Machine

By Frank M. Gentry

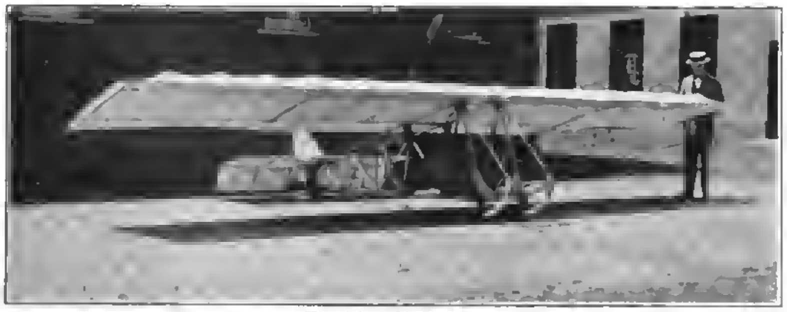
Member Managing Board Aero. Eng. Soc. of Mass. Inst. of Tech.

BEFORE the advent of the aeroplane, the attention of the public had been directed in part to the experiments of Chanute, Lilienthal, and Montgomery, whose performances in heavier-than-air contrivances furnished a substantial background for the present development in the art of flying. With what now appear to have been crude assemblages of wood and fabric, they actually succeeded in making short flights, or more properly, perhaps, *air-slides*, which in those pre-modern days of aviation was a noteworthy accomplishment.

Of no less importance were the early experiments of the Wrights at Kitty Hawk, N. C., which resulted in the installation of the first power unit. Once the machine was constructed, gliding was simplicity itself. It merely involved utilizing gravitation and the opposing air pressure to produce translatory motion. In other words, gliding amounted to nothing more than sliding down an inclined plane of air along the path of least resistance under the influence of gravity. Birds had been observed to glide, but more than that, they had been observed to *soar,*—rise, gain altitude, without the slightest effort on their part to furnish the propelling force. Their native instinct enabled them to sense and use to great advantage the stored energy of air currents and wind puffs. But Nature was not longer to keep her secret from man when Orville Wright in 1911 demonstrated by remaining aloft nine minutes and fifty-four seconds that a heavier-than-air machine could be sustained by the motion of the winds.

This was the first step in soaring flight, but there the matter stood, almost forgotten, for nine years. The great strides in aircraft development and later the Great War thrust it into obscurity until revived by the enthusiasts in Germany after the wings of the Central Powers had been clipped by the Versailles Treaty. Thus arose the new art of utilizing the wind currents in sustained flight.

Motorless flight includes both soaring and gliding flight. Gliding is always the outcome of soaring; the machine soars with every available wind to gain altitude and then glides toward its destination. Granting the existence of the proper currents, soaring depends primarily upon the skill of the pilot and secondarily upon the maneuverability of the plane. This last consideration imposes special requirements in design.



The M. I. T. Soaring Glider

Little need be said of the performances of the Aachen, Harth, Hannover, and von Lossel machines in the Rhoen Valley, as much has already been published, but they may be referred to later for comparative purposes.

The awakening in America naturally followed the rapid spread of enthusiasm throughout Europe. The Aeronautical Engineering Society of the Massachusetts Institute of Technology was one of the first to become interested in the introduction of soaring flight into the United States.

Early in January, after much preliminary discussion on the part of the members most interested, a committee was appointed to make plans and direct the construction of a soaring plane. The two most serious problems confronting the committee were the questions of finance and man-hours. The necessary funds were finally secured by popular subscription among the society membership. A questionnaire was submitted in which each member was asked to fill in the number of man-hours that could be expected from him. With these obstacles successfully surmounted, the committee announced a competition for designs. Out of some five designs received, the judges, Prof. E. P. Warner of the department of Aeronautics acting as chairman, declared Mr. C. T. Allen and Mr. O. C. Koppen winners of the competition.

Construction of Central Wing Section

The original plans were slightly modified to give larger control surfaces and to facilitate ease in construction. The available labor being limited in time and skill, simplicity of construction was one of the deciding factors in the design competition. No variable wing section was attempted. Although the initial plans called for a streamlined fuselage, careful analysis seemed to indicate that the results would not warrant the decreased visibility for the pilot or the attendant structural complications.

The usual stress analysis was made so that the factor of safety would not fall below six. Duplicate pieces were made of the important parts of the machine and tested for their breaking strength in the Testing Materials Laboratory of the Institute. For the most part it was found that the break-

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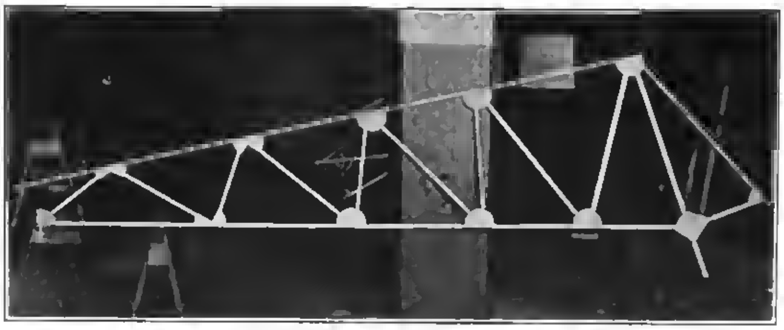
ing strength far exceeded the required values.

The Technology soaring plane is of cantilever construction. It has a hundred and twenty square feet of supporting surface and tips the scales at a fraction less than seventy-three pounds. While every effort was made to lessen the weight without reducing the strength by the efficient use of materials, its lightness exceeded the expectations. Allowing a hundred and thirty pounds as the weight of the pilot, this gives a flying load of one and seven-tenths pounds per square foot. This is about the carrying capacity of the condor and is slightly greater than the loading of the principal successful foreign soaring machines. The wing has a spread of twenty-four feet, a chord of four feet, nine inches and an aspect ratio of five.

A Martin No. 2 wing section was selected as the most suitable for the conditions of soaring flight. The ribs have a maximum depth of seven and one-half inches and weigh four and one-half ounces each. Under actual test, this rib withstood a distributed load of one hundred and ninety-eight pounds before shattering. It is designed to carry a load of sixty pounds, allowing a factor of safety of six. All the ribs are identical except the end ribs which have a depth of two and one-half inches and are cut from ply-wood. The ribs are constructed of spruce with ply-wood gusset plates, glued and tacked at the joints. Their carrying capacity of forty-five pounds per ounce of weight is somewhat remarkable.

The wing is made in three sections to permit ease in transportation. The central section is twelve feet long while the end sections are six feet. The wing spars are of the conventional box type construction of three-quarter inch spruce cap-strips and sides of three-ply ply-wood. The elements are glued and screwed. Two wing spars are provided and, while they are not identical, their depth was made as great as the wing section would permit in order to obtain maximum rigidity. The spars of the central section are tapered in the horizontal plane while those of the end sections are tapered in the vertical plane. The entire wing can be quickly assembled and made secure by means of eight steel bolts in thin sheet steel fittings. When tested, one of these fittings withstood five thousand, two hundred inch-pounds before the supporting frame broke and the rest of the test was abandoned. The internal bracing consists of diagonal guys and light compression members at the ends of the sections. The



One of the fuselage trusses

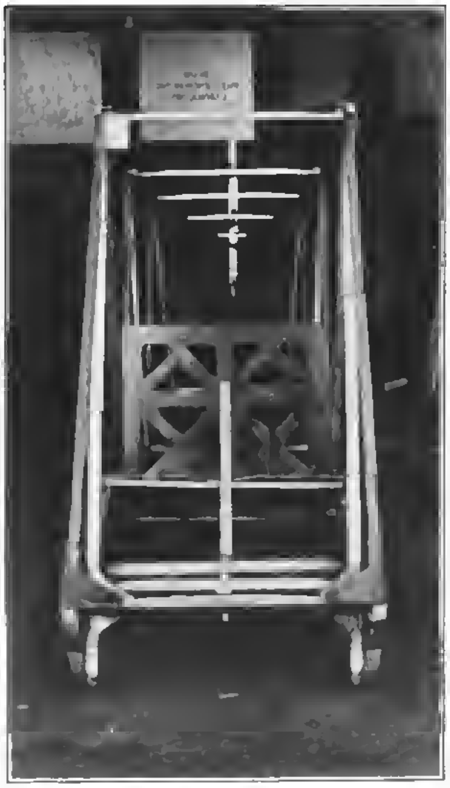
former are of piano wire made taut by means of turnbuckles made from bicycle spokes. The ribs are braced by interwoven tape strips. A balloon cloth weighing one and nine-tenths ounces per square yard forms the covering. Two coats of a special glider dope were applied. The wing has no dihedral, thus permitting greater ease and strength in construction.

The fuselage is of the customary rectangular section, tapering to the rudder post at the rear. For the most part, it is constructed of spruce, although the front members are of ash to add greater strength near the landing gear and pilot's seat.

The joints are made with 3/32 inch ply-wood gusset plates glued and screwed. Under test, a sample joint broke at five hundred and sixty pounds. Each fuselage truss is ten feet long, twenty inches high and weighs four and one-half pounds. The wing is fastened to the fuselage by means of four steel fittings which were found to have a breaking strength of eleven thousand pounds. Little labor is involved in detaching the wing for transportation. A noticeable feature is the absence of external wires, none being present except those necessary for the manipulation of the controls.

The machine is equipped with the usual number of control surfaces. Comparatively large surfaces were used to obtain greater maneuverability. The stabalizer has a span of seven and one-half feet and a width of one foot, nine inches, giving an area of thirteen square feet. Each elevator is hinged to the stabilizer with three light hinges. The elevators are three feet, nine inches long by one foot, seven inches wide. The rudder is approximately twenty-nine by nineteen inches. A slightly smaller rudder was submitted to a sand loading test. The glue under the horn was not dry when the test was made and consequently came loose under a load of eleven and one-half pounds per square foot. The other parts of the rudder showed no signs of breaking. The horns are cut from ply-wood, the holes for the control wires being reinforced with metals washers to prevent wear. The ailerons are six feet long, extending the entire length of the end sections. They have a width of one foot, four inches. A bell-crank control system is used for the ailerons to eliminate the danger of pulleys. A stick and rudder bar are used to manipulate the controls.

The pilot's seat is cut from ply-wood and is located over the rear portion of the landing gear. Two skids, formed from strips of ash and fastened to the lower longerons, form the front landing device. No shock-absorbing mechanism is provided other than the spring of the skid itself. The tail skid is also built up from ash strips but it is provided with a rubber shock-absorber.



Front view of fuselage

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Organizing a Successful Meet

By W. W. Wyman, Mgr., Aeronautical Dept., C. L. Maguire Petroleum Co.

IT is my privilege to attend flying meets in many parts of the country, and I feel it will be a service to aeronautics to tell of the preparation and organization of the most successful meet—the one put on by the *whole* city of Monmouth, Illinois, June 15th to 17th. The population of Monmouth is only 10,000.

About a year ago the Exchange Club of Monmouth, a newly organized luncheon club, composed almost entirely of young business men, decided that they must do something to arouse the progressive spirit of their city. A committee was appointed and after due consideration reported on three plans to accomplish the desired results. They were: (1) An Aviation Field with an annual meet; (2) A City Layout Plan; (3) City Playgrounds.

A fine field was secured one mile from the center of the city, which was leased to the Curtiss-Iowa Aircraft Corporation of Des Moines, Iowa, under contract to equip, operate and maintain a first-class flying field.

The Monmouth Aero Club was then organized with a very large charter membership, who immediately started to work as a *unit* to put on a successful meet. They first secured the advice and counsel of such able men as Major R. W. Schroeder, in charge of the Aeronautical Department of the Underwriters' Laboratories, Inc., and Morrow Krum, aviation editor of the *Chicago Tribune*.

The Curtiss-Iowa Aircraft Corporation took immediate possession of the new flying field, erected a hangar and started operations. The field rapidly gained publicity through several trips to Chicago, strongly featured by Morrow Krum in the *Chicago Tribune*, and many cross-country passenger-carrying trips.

The dates of the meet were set many months in advance and decision made regarding contests and events. The leading merchants, manufacturers and associations were induced to donate a total of nine beautiful silver cups as prizes for the leading events.

75,000 little red stickers, announcing the meet, were purchased and one was pasted on every letter that went out of the city. A supply was given to every traveling man who traveled out of or visited the city, and they plastered them all over Illinois, Iowa and Wisconsin. 2,500 window cards were printed and placed in all stores within a radius of fifty miles. A little folder was prepared, listing the attractions, events and expected visitors, and mailed to Chambers of Commerce, Aero Clubs and operators of aeroplanes. 50,000 schedules of the Chicago-Monmouth Air Route, in operation by the Curtiss-Iowa Aircraft Corporation, were distributed by mail and planes, and then a few days before the meet 25,000 dodgers were distributed by plane over the surrounding cities and towns. In addition to this they advertised in several newspapers in nearby cities, and the Monmouth newspapers, with about 6,500 circulation, ran page after page of free press notices and advertisements.

To quote from a letter from Mr. C. W. Buchanan, president of the Monmouth Aero Club: "We put one man of exceptional executive ability in complete charge as General Chairman to direct all the affairs of the meet, and he in turn appointed his chairmen and assigned to them the various tasks to make up the meet as a whole, and made each responsible for his particular task. This was one of the main contributors to our success.

"We secured the active support of each city and county official and now realize that this support was an essential to success.

"As we had arranged no second prizes we decided to extend the hospitality of the city in entertaining our visitors and guests. On arrival each visitor and guest, including mechanicians, was given a card which entitled him to gasoline, oil, meals, hotel bills, use of Y. M. C. A. swimming pools and full privileges at the Country Club, absolutely free of charge.

"One item which contributed largely to our success was the fine manner in which our traffic was handled, with the result that there were no accidents to cars or pedestrians. This was handled entirely by our local army units, who policed all roads to perfection.

"The road passing the field was confined to one-way traffic and no parking was allowed on any road near the field, though ample parking space was available within the field. This would have been impossible without the co-operation of the county officials.

"Neither were there any accidents to flyers or their ships, due to the able management of Major Schroeder, who had charge of all flying.

"We sold over 3000 advance admission tickets and secured enough rain insurance for the first day to cover our expenses.

"It was a pleasure to see the government pilots ask for service for their ships, then as an afterthought ask what oil and gas we were using, and when they were told it was Lakeside Aviation Oil and Standard's Air Service specification gasoline, to see how well pleased they were and how soon their worry over these items disappeared. Many remarked that we were surely giving away the best obtainable."

There were over 10,000 paid admissions to this three-day meet, which is certainly remarkable for a city of only 10,000 population. These admissions paid all expenses and left a substantial profit. It just shows the real fundamental cause of the financial as well as the operating success of this meet. The whole city, to a man, pulled together as one team with one big idea—a successful flying meet. There were no petty jealousies, no holding back, no pessimists. Everyone, no matter what his position, did what he could to help. Anyone could have asked the Mayor to run a necessary errand and he would have done it without letting it be known that he was the Mayor. Every visitor, whether high army official or mechanician, was treated as if he were the guest of honor. The ones who could take no active part in the planning or organization did take a very active part in making it a success by coming to the meet and paying their admissions. One day of the meet was declared a holiday in the whole city. It was this spirit of unselfish willingness to serve, this spirit of unselfish hospitality, this spirit of united effort that made this meet such a success. And these same qualities displayed by any city or town, no matter what its size, will make it possible for them to run a successful meet. Visitors to the Monmouth Meet will long remember it as the brightest spot in their whole season's work.

Monmouth, Illinois, is destined to be well known in aviation circles, mainly because of its unity of interest in aviation and because of its geographic advantages. It has excellent railroad facilities. It is located about half way, or one-hop distance, in a nearly straight line between six large cities, namely, Chicago and Kansas City, Minneapolis and St. Louis, Omaha and Indianapolis, and very little out of line between Chicago and Omaha. This will make Monmouth the logical stopping place for the air traffic that will some day in the near future operate between all these large cities of the Middle West.

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The Aeronautical Situation in Germany

By William Knight, M. E.

SINCE the end of the war (and before) aeronautical interests in Europe both political and commercial, have been looking upon Germany and the development of German aeronautical activities with a great deal of nervousness.

Germany during the war and since the war stopped has made such substantial progress in aeronautics, that the preoccupation of the rest of the world in its progress is quite justified.

The hesitancy and the lack of a well-defined understanding on the matter of aeronautical policies of the allied nations towards Germany has been the outstanding feature of all the governmental conferences which from time to time have taken place among the allies on the matter of future aeronautical developments in Germany.

A short survey of what the allies have tried to do from the time the armistice was signed up to the present time in order to keep the German flag out of the air and the actual results obtained in this direction will probably be illuminating to all those who are interested in the international aspect of aeronautics.

After the armistice Germany delivered to the allies 1,700 aircraft and the peace treaty signed at Versailles on June 28th, 1919, imposed a number of limitations upon German aeronautical activities and reserved a number of rights and privileges to the allies in connection with civil aviation developments in Germany.

Art. 201 of Section V of the Peace Treaty grants to Germany the right to resume aeronautical construction six months after the ratification of the Peace Treaty, namely: July 10th, 1921. Art. 202 imposes the destruction or the delivery to the allies of all military aircraft and aeronautical equipment.

Art. 313-320 of section XI of the Peace Treaty reserves to aircraft of allied nations up to January 1st, 1923, the right to fly over German territory and to participate in the air traffic in Germany under the same rights and obligations as German aircraft.

On June 20th, 1920, it was decided at the Boulogne interallied conference that Germany was not complying with Art. 202 and in order to make it comply with it, the German Government was notified that the provision of the Peace Treaty regulating aeronautical construction in Germany was amended to the effect that Germany could not resume aeronautical constructions before three months had elapsed from the date when the interallied aeronautical control commission would report that the provisions contained in Art. 202 of the Peace Treaty had been complied with.

On July 10th, 1920, Germany, ignoring the decisions taken by the allies at Boulogne, resumed aeronautical construction and the allies found themselves compelled to include in the protocol drawn up at Spa on July 12th, 1920, the decisions taken at Boulogne.

On January 20th, 1921, the allies requested Germany to accept a distinction formulated by them between civil and military aircraft and set May 15th, 1921, as the final limit for complying with Art. 202 as mentioned above. After an ultimatum was sent to Germany on May 5th, 1921, the German Government accepted on May 11th, 1921, the request made by the allies on January 29th.

On November 16th, 1921, 250 new aircraft built since the armistice, in opposition to the conditions laid out by the allies in the Peace Treaty and in the subsequent interallied conferences, were either delivered to the allies or were destroyed. On February 1st, 1922, the council of allied ambassadors decreed that on May 5th, 1922, the limitations imposed by the allies upon the construction of aircraft in Germany would be removed.

May 15th, 1922, is the date which will mark in the future the official starting point of German aeronautical activities.

In the meantime, while the allies were exchanging notes among themselves and between themselves and the German Government on German aeronautical activities in the future, German aeronautics was progressing in the scientific research field, in the engineering and the manufacturing field and in the organization of aerial commercial lines.

The allies left to Germany, after the war, about 100 old types military aeroplanes to be used for commercial purposes and with such material, from April 1st to October 31st, 1921, these aircraft flew more than one million miles, transported 6,800 passengers and 31 tons of mail and merchandise and on May 5th, 1922 the total strength of German aviation (including the 100 aeroplanes mentioned above) was 225 aircraft.

Two important groups of aerial operating companies have been formed in Germany lately and each one of these two groups has been put under the wings of one of the two large shipping interests represented by the Norddeutscher Lloyd and the Hambourg Amerika Linie, respectively. The first group is composed by Albatros, Junkers, Sablatniz, Rumpler, Oriental Lloyd, Schütte-Lanz, Benz, etc. The second group is composed by Deutsche Luft Reederei, Danziger Luft Reederei, Deutsh-Russische Luftverkehrs Gesellschaft, Zeppelin Flugzeugban, Maybach, etc.

Limited in Germany by the Allies German aeronautical activities have developed abroad. In Italy the Germans are now manufacturing metallic aircraft and a line, Berlin, Roma, Brindisi, Athenes, will be inaugurated in the near future. In the United States the Shütte-Lanz Co. and the General Air Service Corporation, have laid out the basis of a very important aerial service operated with German dirigibles. In Spain the "Zeppelin and American Company" has been incorporated with a capital of 80,000,000 pesetas. In Colombia commercial aerial navigation is operated with a German Company. In Switzerland the "Ad Astro" Swiss Company is subsidized by the German Government (6,500,000 marks in 1922). In Russia the first aerial operating company starting operating there is a German company.

As far as the scientific progress in aeronautics is concerned, we can say that Germany is more advanced in aerodynamical research work than any other country and no other country can boast of having such big men in this line of scientific work as Prof. Prandtl, Prof. von Korman, Dr. Betz and others who have enormously contributed to the progress of aircraft development in Germany and outside of Germany.

It is rather amusing to remember that at the first meeting which took place after the war of the "Societé Aerienne" in Paris in which the aeronautical progress in France during the war was reviewed, the lecturers reviewed . . . . the progress made by the Göttingen Aeronautical Laboratory under Prof. Brandtl.

As far as metallic construction is concerned I think it is freely admitted by everybody that Germany is leading the world.

The German government is giving direct assistance to the air transport industry by the payment of a subsidy

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of 10 marks per kilometer flown for distances under 300 kms., and 11 marks for distances above 300 kms. In addition, in 1921, a sum of 10,-000,000 marks was devoted to the relief of aircraft manufacturing companies. The amounts set aside as subsidies for air transports in 1920, 1921 and 1922 are reported to be as follows:

1920, 12,000,000 marks.

1921, 11,000,000 marks (and 1,-000,000 marks for meteorological services.)

1922, 40,000,000 marks.

I think that from this brief review of cold facts we can draw only one conclusion and the conclusion is that considering that the allies and the United States have not been able to agree on such a drastic policy as would have kept the German flag off the air for ten or fifteen years at least, we have to recognize the fact that German aviation is a factor to be reckoned with no matter if we like it or not and that the best we can do is to deal with it in the same way as a business concern would deal with a dangerous competitor that cannot be put out of business: to make agreements with him, if possible, on the basis of a reciprocal interest or else to compete with him on the matter of prices and quality.

Navy Changes in Liberty Motor Responsible for Improvement in Navy Plane Operations

ALTERATIONS and changes to the standard Liberty engine, by Navy experts connected with the Bureau of Aeronautics of the Navy Department have been responsible for the vast improvement in operating conditions of Navy planes and have made possible long distance flights without mishap or even so much as the change of a spark plug.

The increased reliability of the Liberty engine has been the subject of report and comment by commanders of Naval Air Squadrons operating with the fleets and letters of commendation have been sent to the officers responsible for the improvement by the Chief of the Bureau of Aeronautics.

The Liherty engine which was brought out in this country during the war was designed to fulfill an urgent need for a standardized aircraft engine that could be placed in quantity production at a time when the air forces of the country were expanded from a negligible quantity to a vast fleet of planes outnumbering that of any country in the world. At the time the Liberty engine had the unqualified support of designers and manufacturers in this country, and it was the best product obtainable in aircraft engines. Foreign critics condemned it in no uncertain terms and on numerous and varied counts. In the light of later experience, it has developed that the Liberty was not as was at first claimed for it the perfect aircraft engine. It had many inherent faults which contributed to unreliability and caused many failures and forced landings. On the other hand the many good qualities of the engine were such as to stimulate every effort to correct existing deficiences rather than to turn to new design. To this end the Bureau of Aeronautics tackled the problem and hy starting with the greatest difficulties and working down through to minor faults were able by progressive steps to place at the service of the Naval Air Squadrons engines capable of any duty that might by required of it with a maximum of dependability and endurance.

At the time of the Armistice the Navy had some 4,000 Liberty engines representing an outlay of approximately $16,000,000 of government funds. The engines were subject to unanticipated derangements which necessitated forced landings of frequent occurrence and general overhauls. It will be clear to anyone who has had the least experience with automobile engines that the faults found with the Liberty were such as to cause continuous trouble and derangement.

Among the difficulties experienced were trouble with breaking of timing gears, the oil consumption was excessive, and much trouble was experienced with spark plugs due to their fouling up particularly at low speeds. Cylinder jackets caused considerable trouble from cracking, allowing loss of water which usually resulted in forced landings. Generator failures was another source of trouble and at first it appeared that the inherent design of the Liberty engine was at fault.

The most serious fault encountered was with gear failures and it was to this, that the naval technicians gave first consideration. A re-design of the timing gear was effected and the trouble was completely eliminated. Next the pistons were modified by cutting a groove around the edge of the lower piston ring groove and drilling oil return holes to the inside of the piston. With this change the spark plug troubles were eliminated as it prevented oil from getting into the combustion chamber. It also reduced the oil consumption and as a result of this the oil pressure was raised. With increased oil pressure the bearing life was lengthened and this lengthened the time between overhauls.

In order to eliminate generator failures a flexible drive was substituted and up to the present time has proved altogether satisfactory in flight test. To overcome cylinder water jacket cracking a re-enforcing strip has been welded across the top of the cylinder on the inside of the water jacket with excellent results.

The Liberty engine ignition system had never been entirely satisfactory and recent changes by the Bureau of Aeronautics include the substitution of a twelve-volt ignition system in place of the eight-volt system. This substitution was such that it did not permit the battery to discharge so rapidly. It also allowed much easier starting.

With the above changes in effect the Liberty engine has been in use in planes in the operating squadrons throughout the past winter and spring with excellent results. During the recent ferrying of twelve F-5-L seaplanes from Hampton Roads to Pensacola the performance of the motors reflected the generally excellent results that have been uniformly attained. With the exception of one forced landing due to a leaky water jacket, the engines came through twenty-five hours of flying without the slightest trouble.

In a report to the Bureau of Aeronautics the Commander of the Air Squadrons, Atlantic Fleet, pays high tribute to the work that has been done in this connection:

"In general all the modifications to the standard Liberty have proved of great value," says the report. "The increase in oil pressure has probably doubled the life of the motor." The use of heavy gears has eliminated trouble from this source provided the commanding officers will give their power plants the ordinary care accorded steam power plant machinery.

(*Continued on page* 478)

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AERIAL AGE

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The Detroit Races

AS we go to press over fifty aeroplanes are entered in the National Aeroplane Races to be staged at Detroit from October 7 to 14. There are twenty-three confirmed entries for the Pulitzer Race alone, and it is expected that there will be several others before the list is closed. This contest, with the wide range of types of machines entered, cannot fail to be a classic, and it is to be hoped that the efforts of the Aeronautical Chamber of Commerce will be successful in securing worthy foreign entrants.

The program arranged by the Detroit Aviation Society should have the practical endorsement of everyone interested in aeronautics by their attendance at Selfridge Field from October 7 to 14.

Who Owns the Air?

IN order to assure the future of aerial navigation it may be necessary to carry to the Supreme Court of the United States a case just decided by a justice of the peace in Punxsutawney, Pa.

Over a farm in that euphonious locality flew an aviator utterly disregarding the "No Trespass" signs that were posted upon it for all men to see and take warning.

The flyer, not content with being a mere bird of passage, paused in mid-air to do various hair-raising "stunts," causing the landholder to apprehend that the bird-man might at any minute plunge downward into a grain field or damage a cow beyond repair.

He therefore hastened to the justice's office and secured a summons for the offender, who later was fined the sum of $1, the justice holding that with the ownership of the land runs the proprietorship of the air, all the way up.

If this is the law no airship can fly beyond the range of its owner's realty without trespassing, unless he secures permission from all the land owners below. If the Punxsutawney farmer could forbid "stunt" flying he could probably forbid any sort of flying—for the air and all the rights and easements appertaining thereto are his to have and to hold as long as he pays his taxes.

Thus opens a new and interesting transportation problem. It may be necessary in the future for aeriai passenger lines to buy franchises across the country, availing themselves of the right of eminent domain and condemning air lanes wherever they need them.

This will be expensive and a great incentive to "honest graft."

Franchises are not easily come by, as anyone knows who is familiar with the history of Tammany Hall. Already the members of that institution must be licking their chops as they gaze at the illimitable ether over New York and think what can be got out of getting options on it before they grant anybody any rights to send aeroplanes through it.

Transcontinental Air Mail

THE establishment of a transcontinental air mail service in 1921 was regarded as an extremely dangerous performance. The amount and variety of territory to be covered between our two coasts are great. Both the Rockies and the Sierras must be crossed, and there are only sixteen federal stations on the way. But the completion of a year of flying without a single fatality indicates that a transcontinental air mail service need not be any more dangerous than a transcontinental motor mail service. The mail-carrying aeroplanes last year flew 1,750,000 miles. That is the same as going around the world seventy times. It might be sad work counting motor accidents for such a distance.

Taxicabs of the Air

THE taxicab on land has vindicated itself by its convenience, cheapness and service. A somewhat similar system has already been started for air travel abroad. At the Croyden Air Station, near London, an aeroplane taxi, seating three passengers, is maintained ready for immediate flight, the rate being a flat charge of less than fifty cents a mile. A traveler on an eastbound ocean steamship nearing England can call one of these air taxis by wireless and find it waiting his arrival.

We in America are lagging behind Europe in aerial passenger traffic, but when we get our pace the returning American will find a plane cab or his private air car waiting for him on his arrival to whisk him through to his home in New England or wherever else it may be.

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THE NEWS of THE MONTH

Air Mail Seattle to San Francisco Projected

Seattle.—Air mail service between Seattle and San Francisco within a comparatively short time was forecast by Colonel Henderson, Second Assistant Postmaster-General, who arrived with a party of Postoffice Department officials on a national tour of inspection. "The Seattle to San Francisco service depends on two things," said Colonel Henderson. "We must first secure favorable action on a bill now before Congress giving us the right to have mail carried by private contract, and we must demonstrate the practicability of flying at night. I believe both these contingencies will be in our favor."

Wants Air Station on Barren Island

Barren Island has been suggested as a site for the naval air station now at Rockaway Point by Judge Alfred J. Talley, of General Sessions, in a letter to Admiral Moffet, chief of the Bureau of Aeronautics. Judge Talley is executor of the estate of Andrew White, which with New York City owns practically the whole island.

The letter is in reply to a statement made by Admiral Glennon to the effect that the removal of the air station from Rockaway Point would place the city at the mercy of foreign invaders in case of war, and that there was no other point available for an air station. In his letter to Admiral Moffet Judge Talley said:

"May I not suggest that the dangers and difficulties occasioned by the action of the City of New York in relation to the air station at Rockaway Point can be avoided by establishing the station on Barren Island, which immediately adjoins Rockaway Point. Practically the entire island is owned by one private party and the city, and the unoccupied buildings could readily be made suitable to Navy uses."

In a letter to Admiral Glennon Judge Talley said:

"The plants formerly operating on Barren Island have been practically discontinued. The island is now connected via the Flatbush Avenue extension with the mainland, and the buildings now there could readily be converted to Navy uses."

Barren Island was formerly used as a garbage disposal and dead animal rendering plant, but this use of the island ceased several years ago. The island is more than a mile long and half a mile wide. It is separated from Rockaway Point by Rockaway Inlet. Judge Talley also thinks that the island is so sheltered that aircraft could land and take off in the same waters they now use. He thinks that it has all the advantages of Rockaway Point and none of the disadvantages.

Aeroplane to Locate Alaska's Lost Lakes

Locating and photographing undiscovered lakes in the national forests of Alaska are the latest uses to which the aeroplane has been put, says the Forest Service, United States Department of Agriculture.

It has long been known that there are many lakes on the headlands and islands traversed by the inside passage between Seattle and Skagway that do not appear on any map. During the New York-Nome flight made by Army aviators, lakes were frequently sighted which could not be found on the latest and most authentic maps of the territory. Tales of unknown water bodies are constantly being brought in by trappers and prospectors. Less than a year ago a lake 4½ miles long and ½ mile wide was discovered at the head of Short Bay. This lake has over 1,000 acres of surface area and is less than 1¼ miles from tidewater, yet because of the surrounding country's rough topography has remained unknown and unnamed.

Recognizing that many other of these "lost lakes" may be sources of valuable water power, the Forest Service has laid plans to map this no-man's land of the north by means of aerial photographs. A few days' flight, it is said, will be sufficient to

The F.P.2 seaplane, built by the Dayton-Wright Company, especially for photographic work, mosaic and oblique, now being used by Walter E. Lees to make a mosaic of a thousand square miles of timber land for the Spanish River Pulp Co. of Canada. In the group are Walter E. Lees, pilot; Milton S. Beal, and J. R. Doty, camera men; Arthur Hayden and William Whitman, mechanics

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cover the area with a degree of accuracy that would require many years and great expense to accomplish by ordinary methods.

The work, which has been approved by the Federal Power Commission, will be done by seaplane, flying from Ketchikan as a base.

The American Entries in the French Gliding Contests

The first successful gliding tests to be held in the United States since the Wright Brothers' experiments, which ended in 1903 with the world-famous initial flight of a motor-driven aeroplane, were announced today by the Aeronautical Chamber of Commerce of America.

The experiments were made on June 12th. at Ipswich, Mass., by three students of aeronautics at the Massachusetts Institute of Technology, Cambridge, Mass., who sail Saturday on the French liner La Savoie, to participate in the First International Gliding Contests, to be held August 6th to 22nd, at Clermont-Ferrand, France.

The participants on behalf of the Aeronautical Engineering Society of the Massachusetts Institute of Technology, are: Edmund T. Allen, age 26, of Chicago; Harry C. Karcher, age 20, of Mansfield, O., and Otto C. Koppen, age 22, of Mamaroneck, N. Y. Mr. Allen, who was formerly a test pilot for the Army Air Service at McCook Field, Dayton, O., is the pilot. The chief designing work, with the asistance of the Aeronautical Society, was done by Mr. Koppen. Mr. Karcher had charge of the practical construction of the glider.

The entrance of the United States into the international competion in France marks a new phase in the development of American aeronautics, according to officials of the Aeronautical Chamber of Commerce. Germany, deprived of the privilege of orthodox engineering, after the Armistice, turned to motorless aeroplanes, and at a competion last Fall, distances as great as 15 miles were traversed by gliders. France was quick to arrange for a general contest and experimentation has been going on ever since in most of the large nations of the world. There probably will he three score entrants in the French affair.

Messrs. Allen, Karcher and Koppen constructed a glider at the M. I. T. laboratories and on June 12th, Mr. Allen took it to a 50-foot elevation at Ipswich, Mass. He rose in a fifteen-mile head wind. Altogether five successful flights were made. The velocity of the wind was such that the machine hovered practically the entire time. It reached a maximum elevation of twenty feet and advanced a maximum distance, in one flight, of 200 feet.

As a result of these trials, the young men, with the assistance of other aeronautical students at Cambridge, redesigned the glider into what they believe is the most efficient type yet produced anywhere in the world. The frail little aircraft, now stowed away aboard ship, has a span of 24 feet, a chord (or width of wing) of 4 feet 9 inches and measures 16 feet overall. It is of spruce and fabric construction and weighs but eighty pounds. The most successful of the famous German gliders weighs 149 pounds. Yet the Cambridge craft has a factor of safety of four. It is asserted by the builders that the craft has greater ease of control than the ordinary type of plane, having ailerons, rudder and flaps, the full length of the monoplane wing.

"The American aircraft industry will watch the results of the French competition with keen interest. The attention of the world is divided between the helicopter (machine capable of vertical flight) and the glider, or motorless aeroplane. Both have much to contribute, but the glider appeals probably more to sportsmanship. A great deal should be learned aerodynamically from motorless flight."

Notice to Aviators

At High Hill Beach, New York via Belmore, L. I., near U. S. Coast Guard Station No. 87, there is a large wooden platform painted green, with large white numbers 87 on the upper side. It is surrounded with green grass approximately two and a half to two feet in length, forming an apparently level surface of about one-half mile wide and two miles long. From the air this would appear to be an ideal landing field, especially as there is an indication that the numbers 87, but in reality it is exceedingly marshy and swampy ground, and should an aviator attempt to alight thereon there would undoubtedly follow some damage to the aircraft.

Correction

In our issue of August we stated that the flying field at Kansas City consisted of 53 acres, whereas as a matter of fact the field contains 153 acres, a portion of which has been leased to the Government. The contract for the erection of Government equipment has been let and the work should be completed sometime in October.

Aerial Mail Night Flying

Experiments have been made by the Post Office Department from time immemorial for the improvement of the mail service to the citizens of the United States, but never before has the Department been pushed to experiment above the clouds. It is all due to the fact that the Post Office Department is considering establishing night flying.

Flying by night means much more than flying by day. It means lighted fields. Also it means constant communication between the planes in flight and the stations. At Bolling Field, Washington, D. C., a mail plane has been fitted with both receiving and sending radio telephone apparatus for communication tests. During flights over the capital city above the clouds conversation has been maintained successfully with the radio telephone station in the Post Office Department building.

Just as ships on the ocean, without radio lose themselves if the sun and the stars are obscured, the ships of the air lose themselves. At night air mail planes without radio equipment would be very apt to lose their way, run out of gasoline and finally crash to the ground. The Post Office Department wants to establish good air mail service, hut it insists that the service must be safe.

With radio telephone equipment, ships could be given their position in ten minutes or less, it is estimated by officials of the Air Mail Service. The operation would be something like this: An air mail plane flying at night would call for its position. Radio operators in the stations from which the plane departed and to which it was going, by means of rotating finder would determine the exact direction the message came from. One station would then report the angle to the other station. This operator would draw a triangle on a map from the information received. The plane, of course, would be at the apex of the triangle. The flyer informed of his position, could quickly make his way back to the route.

Radio will also be used to report ground conditions at the stations to planes in flight. If a heavy fog settles over San Francisco the flyer with mail will be warned to land some place else. The passenger and mail planes between England and France are equipped with radio sets for such emergencies.

Further experiments which will now be conducted by the Air Mail Service, look toward simplifying the radio equipment in order to reduce the weight. The air mail plane detailed at Bolling Field now carries

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radio equipment which totals about 200 pounds. It is believed this can be reduced at least one-half.

The mail plane reels in its experimental antennae like a fisherman reels in a trolling line. The antennae consists of a 300-foot copper wire which sails out behind the plane when in use, weighted by a little lead fish. Electric current to operate the radio telephone is manufactured by a generator run by a fan which spins at high speed as the plane rushes through the air. The radio receivers are enclosed in rubber cups to permit the pilot to hear the radio conversation above the roar of the motor.

Seaplane Mail Service

Sea plane mail service at New Orleans will be established soon, according to an announcement given out by the Post Office Department, in line with the policy to speed up mails at the chief American ports. The plane will catch outgoing steamers with late mail and bring in mail from the steamers half a day ahead of time.

Announcement is also made of the placing of sea posts on five Oriental steamers of the Shipping Board using the port of Seattle. Mail sorters on these steamships will sort the mail even down to carriers' routes for Seattle. At Victoria a sea plane will take the mail to the city 84 miles away and delivery will be made before the boat docks. At New York a special mail boat has been in service for some time taking off mail as the steamers arrive at Quarantine. A sea plane has been in service at Seattle for the period of a year and the results have been satisfactory. It was found, however, that to obtain the best service it was necessary to have mail clerks on the steamships.

A Plane Which Cannot Spin?

Is the Petrel, which is now under test at McCook Field by the Engineering Section of the Air Service, so balanced and designed that a tailspin is impossible? This question has come up during the tests, in view of the fact that no pilot has been ahle to make the plane spin.

This question has probably to do with the center of pressure travel on the Gottinenn 387 wing.

The plane has been flown by Captain McCready, by Captain Mosely, by Art Smith, by Meister and by Pat Moriarty, for the Army, and by Mr. George B. Post for Huff, Laland & Co., its manufacturers. It has been looped and rolled. It has been flown in mimic combat by Pat Moriarty against the Vought, and has been placed in nearly every conceivable position. But no one has been able to make the plane spin.

All of the pilots who have flown it have reported enthusiastically concerning its maneuverability and ease of control over a speed range of nearly sixty miles. It is quite sensitive to all controls, and very easily and quickly turned. But, evidently, the plane will not spin.

When placed in positions where it should stall, with the controls so placed as to drop the plane "into it," the Petrel seems to fall off its lower wing in a side slip, from which it will emerge in a dive if let alone. Further information on this feature of the plane will be very interesting, in view of the efforts which have been made to design a plane which cannot fall in a tailspin.

Aeroplane view of Utah Copper Co. mine at Bingham, Utah, showing system of surface mining by steam shovel on terraces. Forty thousand tons of ore per day are removed when this mine is working full capacity. Photo by Capt. Le Mar Nelson, U. S. Air Service, Salt Lake City

Goodrich Re-enters Aeronautical Field

The B. F. Goodrich Ruhber Company has announced its intention to resume the development and sale of aeronautical rubber products. The company's activities in this direction will embrace every field of aeronautics, including supplies for both lighter-than-air and heavier-than-air craft.

It will be remembered that during the war Goodrich was very active in this field, producing various types of balloons and large quantities of tires and supplies for the government.

The present decision to resume aerial operations has resulted in the addition to the company's personnel of Mr. Henry Wacker. Mr. Wacker, an experienced and practical aeronautical man, was formerly connected with the Curtiss Aeroplane & Motor Corporation and more recently with the Aerial Mail Division of the Government Service.

The Goodrich Company's resumption of activities in this field is significant of its belief in the future of the aircraft industry. With the experience gained during the war period, the company is well fitted to continue the development of this line of industrial merchandise.

To Use Duralumin in Goodyear Ship

AKRON.—Duralumin will be used in the construction of the new government semi-rigid dirigible, by the Goodyear Tire & Rubber Co. of Akron, aeronautical engineers of the company announce.

The ship will be the largest semi-rigid dirigible ever designed and constructed in the United States and will be 290 feet long, with a capacity of 700,000 cubic feet of gas. It will be designed and built to carry helium gas in place of hydrogen gas. The bag will be 71 feet in maximum diameter. The ship will be equipped with four Liberty motors and two propellers in conjunction with two reduction gears for the purpose of getting higher propeller thrust efficiency.

The keel of the ship will be entirely of duralumin. The keel will be of triangular cross-section running from nose to tail, with a large structural nose cone and fixed tail surfaces all built into the keel, the idea being that considerable support will be gained from this structural backbone of the ship, thereby reducing car flying pressures.

The ship will have two gas compartments and two air compartments. It will have a speed of 70 miles an hour and will carry 15,000 pounds of gasoline.

The ship will have a crew of 12, with complete facilities for carrying 20, including six sleeping bunks, electrical cooking facilities and many of the conveniences common to modern ocean-going vessels. It will carry three cars—the forward one being 50 feet long and 8 feet wide. The two power cars, each equipped with two Liberty motors of 400 horsepower each will be 20 feet long and 6 feet wide. All cars will be constructed entirely of duralumin members covered with duralumin sheeting. The total horsepower will be 1600. The motors, however will be throttled to reduce this to about 1200 horsepower for the purpose of increasing the durability of the engines. Facilities will be provided for free communication between the three cars through a passageway through the keel of the ship.

Means of getting on top of the huge gas bag will be provided through a vertical shaft 70 feet long, and a machine gun will be mounted on the top of the envelop to assist in protecting the ship during flight. Three other machine gun nests will be located in the lower part of the ship.

Grover C. Loening's Message to Aeronautic Executives

At the luncheon of the Aeronautic executives held at the Automobile Club of America, on July 12th there were present a great many of those who form the nucleus of the largest aircraft companies in the vicinity of New York.

In the spacious, airy banquet hall adjoining the library was set the luncheon table. Just behind the speaker's chair, raised on a small plat-

The Elias EM1 Expeditionary interchangeable land and water biplane

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form stood the radio receiving set. Sharp at one o'clock by Washington time via the radio the luncheon began. During the course of the first half-hour thereafter, the weather reports came in, followed by wireless music.

It was sincerely regretted by those present that Colonel Henderson was unable to attend; but according to the telegram read by the chairman, R. R. Blythe, he was unexpectedly called to the Pacific coast owing to the crisis of the railroad strike. R. R. Blythe stated that the succeeding luncheon would be held when Colonel Henderson was available to speak.

Grover C. Loening, president of the Loening Aeronautical Engineering Corporation, president of the Aeronautical Chamber of Commerce and well-known authority in aviation was introduced by the chairman as the speaker.

"Gentlemen, there is one vital message which must be conveyed to every one in aviation and to all others who are interested in aviation and to the public in general; and that is, that America leads the world in aviation.

"This is not a statement brought up by heated argument but one that is conveyed by cool judgment. We have here in the United States every world air record except the one-half kilometre speed record! This in itself is proof enough that our planes are the leaders of all other countries.

"The general opinion of everyone is that America lags in aviation. We must combat this viewpoint with the conclusive facts that we lead the world. We have no Government subsidies to pay half our passengers' fare, we are hreaking in from the solid rock foundation and yet with all we have done there are many who say that we are behind Europe.

"Compare the number of passengers carried, compare the miles flown. United States so far has equaled or exceeded Europe in both the number of passengers carried and the miles flown.

"It means bank credits, and public confidence when we ourselves know and can feel the security that we do lead in aviation. It is one of the most vital things that we have to overcome today," said Mr. Loening. "We must have the self-assurance that we are on the winning side and going ahead. First convince yourselves and then in the expression of today—'You tell the world.'"

Plans to Center Aircraft Industry in Illinois

Seventy-two leading business men, including manufacturers, bankers and merchants, held a meeting in the office of Mayor Thompson of Chicago, July 29, to make plans for landing the aircraft industry for Chicago.

Illinois lost the automobile industry because the people were not so active as the enterprising citizens of Detroit. If they can secure the aircraft industry—make Chicago the center of the aeronautical business of this country—they feel they will wipe out the motor car deficit.

"Chicago lost the automobile industry to Detroit," said the mayor. "As a result, Detroit has grown from a sleepy old town of a quarter of a million people to a population of approximately one million, gaining enormous wealth. Detroit today is bragging that she is going to overtake Chicago in population. The aircraft industry has arrived at a point where it is about to experience great expansion and prosperity."

Charles S. Rieman, president of the Chicago Aeronautical Bureau, which is conducting the active campaign to make Chicago the center of the aircraft universe, said:

"The country's leading transportation authorities—heads of big railroads and steamship lines—predict that the next few years will witness such an increase in air transportation that it will become one of the principal forms of industrial activity.

"Chicago now has no facilities for the manufacture and operation of aircraft, but by promptly supplying suitable landing fields and manufacturing sites, many young companies can be induced to move their factories to Chicago. If we wait until they have grown and established themselves elsewhere, we will lose them. Now is the time for Chicago to take advantage of her opportunity."

Ralph C. Diggins told how the company of which he is the head had made more than 15,000 flights in Chicago during the last year without a single serious accident. William P. MacCraken, Jr., chairman of the Committee on Aeronautical Law of the American Bar Association, urged adequate landing fields.

J. F. Cornelius, vice-president of H. O. Stone & Company, said that Chicago had been designated as the headquarters for the transcontinental air mail service as one result of the activities of the Chicago Aeronautical Bureau. A large sum of money was being expended to make the Chicago Air Mail landing field one of the finest in the country.

Mr. Cornelius then outlined the plan of the Chicago Aeronautical Bureau for making Chicago the center of the aircraft industry, as follows:

First: To bring to Chicago practically all of the people engaged in aeronautical activity in this country, in order that we may convince them in a wholesale way that Chicago is the best place in America in which to manufacture aircraft and from which to operate the air transportation lines.

At the conclusion of Mr. Cornelius' remarks, John M. Glenn, Secretary of the Illinois Manufacturers' Association, and George B. Foster of the Commonwealth Edison Company both expressed hearty approval of the purpose and plans of the Chicago Aeronautical Burcau, and upon motion of Mr. Glenn, seconded jointly by James S. Agar, president of the Agar Packing and Provision Company, and Robert M. Birck, president of the Cleaners' and Dyers' Association, the following resolution was unanimously adopted:

That it is the sense of tbis meeting that we approve the plans of the Chicago Aeronautical Bureau to make Chicago the center of the aircraft industry, and that immediate action be taken to provide the necessary funds.

The Chicago Boosters' Club headed the list with a subscription of $5,000.

Florida Aviators to Make Cross-Country Flight

Mr. H. E. Cornell, vice-president of Glen Saint Mary Nurseries of Winter Haven, Fla., very well known all over Florida for his interest in the development of the citrus industry; Mr. George W. Haldeman, ex-Army officer, member of Aero Club of America and Aerial League of America, president of the Inter-City Airline Corp. of Lakeland, Fla., well known in exhibition work over the Southern States for the past three years, having filed exhibition contracts at most of the largest fairs in the South.

Cornell and Haldeman left Lakeland, August 7th, at noon, by train arriving in Dayton, Ohio, August 8th, where they have purchased a new high-powered commercial aeroplane of the Johnson Aeroplane & Supply Company of Dayton. The machine is powered by a 225-h.p. Benz motor and carries a gas supply of ninety gallons, capable of about six hours' flying. Her average speed is approximately 120 miles per hour.

Messrs. Cornell and Haldeman declare that they are not intending to break any cross-country flying record but are merely taking a 7,000-mile pleasure trip hy air. Their new plane has been christened the "Skylark."

The start in their plane will be made at Dayton, Ohio, their course taking them through St. Louis, Kansas City, Denver, Salt Lake City,

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Boise, Idaho, and Walla Walla, Wash., which is their destination going out, Mr. Cornell expecting to visit for some time there with his brother, W. B. Cornell.

En route to Walla Walla the aviators expect to stop at McPherson, Kan., Mr. Haldeman's old home, where they will visit for a few days. They expect to make several side trips from Walla Walla, one of which will take them to Seattle, Wash., on the coast, from where they will start their return trip. The return will he made over a northern course, through Montana, North Dakota, Minnesota, Wisconsin, Chicago, Ohio and Pennsylvania to New York City. Here the aviators expect to spend about a week.

From New York they will return to Florida via Washington, D. C.; Newport News, Va.; Wilmington, N. C.; Savannah, Ga., and Jacksonville, Fla., bringing their trip to a close at Winter Haven, Fla., Mr. Cornell's home.

Mr. Cornell has for the past year been flying with Mr. Haldeman on business trips around Florida and during the past sixty days has completed a course of instruction of one hundred hours in the air, having as his instructor Mr. Haldeman, who has approximately two thousand flying hours to his credit.

After learning to fly Mr. Cornell was so impressed with the safety and practicability of the aeroplane that he decided to purchase a higher powered machine, and, together with Mr. Haldeman, tour the United States.

Plans of the International Manufacturing Co. of Los Angeles

The development of Airway Load Carriers by the International Transportation & Manufacturing Company of Los Angeles, is a new step in the effort to provide commercially efficient aero transportation. The Airway Load Carrier is designed, in a sense, as a combination of heavier-than-air and lighter-than-air principles, but its originators assert that it is distinctly a third type of aircraft.

The development was reached through several years of preliminary work and testing by the Hall Aeroplane Company, a California corporation, capitalized at $500,000. Most of this work was done at Los Angeles and Berkeley, California. The prime mover in this development is Charles S. Hall of Los Angeles, formerly an automotive engineer, and associated with him are G. B. Hannaman of Auburn, California, and D. Nelson Clark, of Long Beach, California, and a number of other Western men who are interested in aeronautics. Mr. Hall began the development of propellers after some years of study of propeller efficiency and has obtained patents on an entirely new type known as the "Hall helicoidal propellers," in which efficiency begins at the huh through special arrangement of a helicoidal projection. Tests of this propeller have demonstrated unusual efficiency and very quick "bite" of the air when the propeller is started. This feature was sought by Mr. Hall to bring about an efficiency desired in the handling of large aircraft, especially in taking off and alighting. It is also utilized to give an increased lift by using Hall propellers on a newly developed application to heavier-than-air craft.

The development of plans for the production of Airway Load Carriers has been very thorough and has taken four years of constant experimenting and research. This has been carried on alike from the engineering and commercial viewpoints, so that a system of tariffs and special marketing has been developed along with the plans for construction. As a result, the company begins its active work with an established method for determining the costs of operation and for practically laying out schedules and placing terminals and stations along with a system of calculating and undertaking the engineering features of construction.

Surveys which have taken a number of years have been made for routes and the establishment of landing locks and stations and radio compass stations across the country and into Mexico. The system of computing tariffs has received the assistance of traffic men and has also had the supervision of experts in other lines who have made sure that nothing was neglected in the plans. This has been followed by rigid cost analyses in which every charge—capital outlay, gross operating, etc.—has been taken into account and for which standards have been estahlished for salaries, wages, depreciation, liabilities. damages, legal burdens. terminals and stations, subsidiary trucking companies, etc.

A method of mechanically handling the alighting of these craft and of locking them in loading stations and a very ingenious and rapid means of handling freight to give greater safety and expedition have heen developed. The Company has acquired many basic patents and has others in the course of issuance on special features relating to the Airway Load Carriers and other aircraft accessories, and expects to have more than one hundred patents before completing protection on the essentials and accessories already developed. D. Nelson Clark, counsel for the Company has been spending the summer in Washington and New York, looking after patents and other developments.

Curranium gas is not owned by the International Transportation & Manufacturing Company, as has heen stated, but is privately owned by individuals, and no stock relating to its production is on the market. The owners of Curranium and Dr. Curran are interested, however, in the International Transportation & Manufacturing Company, and that concern holds an option on the use of the gas in aircraft work following its production.

The International Transportation & Manufacturing Company will construct Airway Load Carriers of moderate capacity at the outset and put them in a combined freight and passenger business. The first fleet will probably have no carrier of more than eighteen tons pay-load capacity. The cost analysis of operation of these craft are, at present, based upon the use of Liberty engines, although Mr. Hall and his associates believe that the larger load carrying aircraft must sooner or later come to a more efficient means of power than the internal combustion engine.

The International Transportation & Manufacturing Company is capitalized for $2,500,000. It maintains general offices at Suite 824-827 San Fernando Building, Los Angeles, but expects to establish its initial factory at San Diego, where land has been acquired for that purpose.

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Air Service R. O. T. C. Summer Camp Opens at Kelly Field

The Air Service R.O.T.C. Summer Camp, under the command of Major C. W. Russel, A. S., (D.O.L.), opened at Kelly Field on June 15th with sixteen Texas A. & M. College students in atendance. It was originally planned to have about thirty students at the camp this summer but, due to the rigors of the 609 (physical) examinations for pilots, the remainder were disqualified.

The course of instruction is very practical, and is being made as comprehensive as possible for the six weeks' duration of the Camp. Theoretical instruction is being reduced to a minimum, due to the fact that this has been largely covered during the students' course at College. The mornings are devoted solely to flying, while the afternoons are given over to necessary lectures and conferences on the next day's missions. Instruction and practice is being given in every phase of hack seat work.

The students are all very enthusiastic about the flying game, and will undoubtedly prove consistent boosters for the Air Service.

Engineering Men Visit Chanute Field

The Society for the Promotion of Engineering Education, consisting of professors and instructors in Engineering and Mechanical Work from the various technical schools and universities in the United States, were guests at Chanute Field, Rantoul, Ill., recently. A special car brought the visitors to the field, where they were conducted in small parties, through the Air Service Mechanics School by the officers, noncommissioned officers and civilian instructors. Each party visited each course of instruction in operation, which was explained very carefully by the guide.

At the completion of their tour of the departments and hangars a flying exhibition was given to afford the visitors an opportunity to study the various types of aeroplanes in use. The aeroplanes were DH4B's Fokker, SE5's, and the T.M. Scout. The visitors expressed themselves as greatly pleased with the afternoon spent at the field and at the manner in which the training of mechanics is being conducted at this school.

Bombing Maneuvers at Galveston, Texas

A crowd, variously estimated between 25,000 and 50,000 people, witnesed the bombing of the schooner *Navided* off Fort Crockett, Galveston, Texas. The seawall was black with spectators and cars were parked wherever room was obtainable. From a tactical standpoint, the exercises were a marked success. Those who knew what it was all about had ample demonstration of what the Air Service, properly equipped, can do to ships at sea, and the pilots who took part are entitled to the satisfied smiles they are wearing. All of the hombing was done with dummies of tile, since the live bombs obtained could not be

Construction frames of the giant dirigible ZR1 at the Naval Aircraft Factory, Philadelphia

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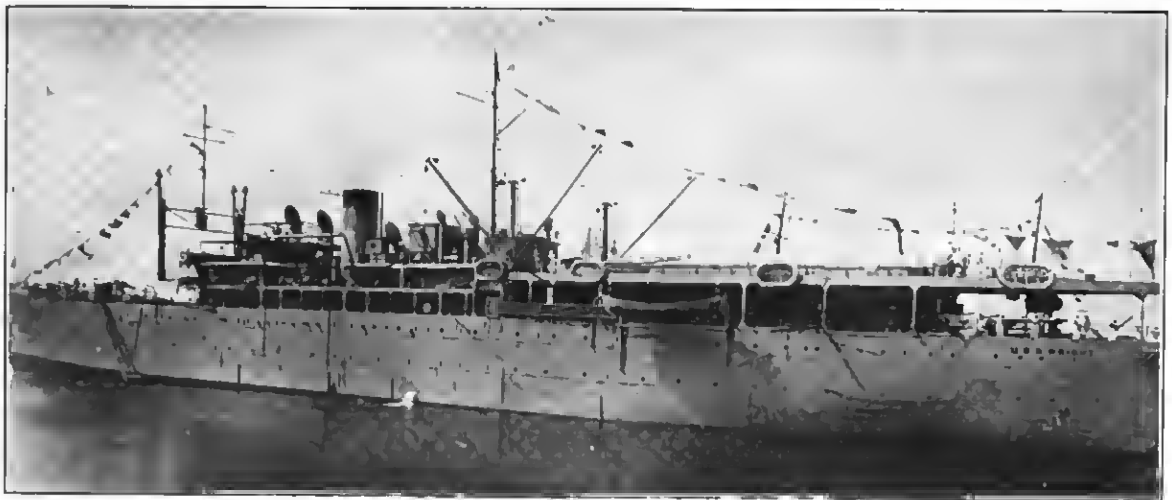
The U. S. S. Wright fleet tender for the Atlantic Fleet Air Squadrons

used in racks of the type with which the ships are equipped. Even so, the last attack left the *Navided* on fire in the hold, to burst into flames upon the withdrawal of the planes. The opening attack was made with two 5-ship formations of SPAD XIII's dropping four 25-pounders and getting a very creditable percentage of hits on deck, in spite of the fact that the minimum altitudes for live bombs were adhered to. The SPADS were followed by a formation of five DH4B's from Kelly Field dropping full loads of 25-pounders.

It was obvious to any observer that, if bombs of the types ordinarily used against craft of this type had been employed here, every seam in the hull would have been wide open to the sea after the DH's were half through. This attack was followed by two formations of SE5's dropping 4 bombs each, 3 of the planes remaining to attack with machine guns.

The First Pursuit Group expects to have more of this sort of thing at Selfridge Field, the unused shallow portions of Lake St. Clair offering a convenient location for either practice or demonstration.

Opening of R. O. T. C. Students' Camp at Mitchel Field

The R.O.T.C. Student's Camp for the 25 students of the Massachusetts Institute of Technology officially opened at Mitchel Field, L. I., New York, on Monday, June 19th. The students arrived June 15th, and were immediately quartered in barracks previous provided for them. The mess was opened and camp routine fully established in order that the schedule of instruction might start promptly at 8:00 a.m., Monday, June 19th. To date the schedule as previously submitted for this camp has been carried out fully. There have been interruptions in the flying portion of the schedule due to inclement weather. This, however, has been made up in the afternoons and on Saturdays. The students are receiving on an average of one hour of flying per day. No pilot instruction is, of course, being given them, but they are being given flights in connection with the instruction in photography, aerial observation, map making, etc. The school is operating more smoothly and harmoniously than was anticipated. It would appear from reports that the students are enjoying the course and are finding it very instructive. In order to carry out the program, eight aeroplanes are being detailed daily to the duty of flying these students.

Eberts Field Reunion

There will be a reunion of the men who were at Eberts Field, Lonoke, Ark., during the war on September 21-23 inclusive. Headquarters have been established at the McAlpin Annex, formerly the Martinique, New York City, and complete information can be had there from Lt. J. E. Bullock. An excellent program is being arranged and it is hoped that every man who trained at Eberts Field will respond.

Army Flyers Make 122 Miles an Hour on Overland "Hop"

Washington.—Lieut. James H. Doolittle and Leland S. Andrews, Army Air Service, flew from Kelly Field, San Antonio, Tex., to Bolling Field, Washington, a distance of 2,080 miles, in eighteen hours.

This announcement was made by the War Department. The fastest time made by Doolittle and Andrews was when they flew from San Antonio to Jacksonville, Fla, with short stops at Houston, Tex., and Pensacola, Fla., a distance of 1,220 miles, which was made in ten hours' flying time, an average speed of 122 miles per hour.

They flew from Jacksonville to Washington, a distance of 860 miles, with a short stop at Langley Field, Va., in eight hours.

Night Flying Tests

Further experiments in night flying by the Post Office air service will be started at the McCook Field, Dayton, Ohio, to supplement tests being made in radio communication at Bowling Field, Washington.

A mail aeroplane has been ordered transferred from the Chicago station to Dayton, where the experiments will be pushed ahead rapidly. Under the direction of army experts in night flying this plane will be provided with searchlights and other necessary equipment for flying in darkness, after which actual flights at night will be made.

At the present time there is only one other aeroplane in the United States equipped for night flying. It is at the McCook field, Dayton.

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REVIEW of WORLD AERONAUTICS

New British Air Service

The British Air Ministry announces:—A scheme for the establishment of air services between Southampton and the French ports of Cherbourg and Le Havre has been approved by the Air Ministry. The services will be operated under the general terms of the subsidy scheme made public in June of last year.

A new company, probably with the title of the British Marine Air Navigation Company, Limited, is being formed to operate these new services, and in addition to the promoting company certain shipping companies will be financially interested in the scheme.

These services mark an important stage in the development of commercial aviation as the company will use, for the first time, marine aircraft designed and built by the Supermarine Aviation Works, Limited. The existing British services use land types of aircraft only. The need for establishing services using this type of aircraft was emphasized in 1919 in the Report of the Advisory Committee on Civil Aviation.

The main object of the scheme is to shorten the Cross-Atlantic journey by picking up passengers from Cherbourg, conveying them rapidly by air to Southampton, and thence onwards to London by train. In addition, the company intend to operate a Southampton-Le Havre service in order to speed up travel on the Cross-Channel section between London and Paris for passengers proceeding by this route.

In both these schemes the company has the active cooperation of the London and South Western Railway Company in connection with through bookings between the terminal points on each route.

Subsequently it is proposed to operate a service betwen England and the Channel Islands for passengers, produce, newspapers and mails. This air service will also reduce very greatly the time taken between the Islands and the mainland.

The company will receive a subsidy of 25 per cent on the gross earnings from the carriage of passengers, goods and mails, and also a payment of £1 10s. per passenger carried and 1½d. per lb. of goods carried. The latter payments are half the sums paid to approved companies operating the London-Paris air services.

The French authorities have been approached for the provision of the necessary customs facilities at their ports, and the French railway companies concerned are also assisting by providing suitable train connections on their part of the through route to Paris.

Saying It with Flowers by Air

Information that Dutch florists have adopted the expedient of sending their flowers daily to the London market by aeroplane has been received by the Department of Commerce from Trade Commissioner Howard W. Adams, The Hague. The flowers are cut at night, packed early the next morning, and sent by motor-car from the Boskoop flower growing district to the Waalhaven aerodrome near Rotterdam. They arrive at Croydon, England, at 1:30 P. M., and from there are despatched by motor-car to the London florists. Boskoop flowers are thus put on sale simultaneously in the London and Dutch shops. About 100 kilograms of flowers per day are to be transported in this way.

Navy VE7 seaplane leaving turntable catapault on the U. S. S. Maryland

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Spain-Argentina Line

Washington.—A despatch received from Ambassador Cyrus Woods announces that an airship service across the Atlantic Ocean from Seville, Spain, to Buenos Ayres, Argentina, will be established.

The enterprise, Ambassador Woods states, is being financed partly by British capital. It is hoped to inaugurate a regular airship service within the next two years. Sites for aerodromes have been obtained in both cities and building operations are to start soon.

The airships to be used in the transatlantic service will be somewhat larger than the ill-fated R-38. They will be driven by nine Maybach engines, each of 400 horsepower. Four engines will be placed on either side of the ship, with one in the stern.

The plans call for cabin accommodations for forty passengers. Space for passengers is to be limited so that the major part of the carrying capacity can be utilized for the transportation of mails. It is proposed to establish a postage rate of 75 cents per letter, while $1,000 will be charged per passenger.

The cabin will be situated in the forward part of the hold and includes quarters for the ship's officers, a saloon, a kitchen and a smoking room. Space for baggage will be provided along the keel.

Traffic on Cross Channel Routes

The British Air Ministry announces:

The returns of air traffic on the Cross-Channel routes to Paris, Brussels and Amsterdam during the three months, April-June, are now available.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Limited, the Instone Air Line and Daimler Hire, Ltd. The figures by nationality are: British, 915; French, 228, and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 traveling in British machines against 1,653 in the same period last year. British traffic, therefore, amounted to 76.8 per cent of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air services continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was 92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were: April, 71.3 per cent; May, 85.0 per cent, and June, 79.1 per cent.

Notwithstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if air transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent in April, 30 per cent in May, and 31 per cent in June, and the useful cargo capacity used only 44 per cent in April, 44 per cent in May and 40 per cent in June.

British Air Council

An Order in Council to be published shortly by the British Air Ministry enacts that the Air Council shall consist of the following members:

One of His Majesty's principal Secretaries of State, who shall be president of the Air Council.

The Parliamentary Under Secretary of State for Air.

The Chief of the Air Staff.

Air Member for Personnel.

Air Member for Supply and Research.

The Secretary of the Air Ministry.

The main intention of the New Order in Council, which replaces that of October 13, 1920, is to redistribute the business of the Air Council and adapt the organization of the Air Ministry in such a way as to meet new requirements and increased responsibilities, and in particular to relieve the Chief of the Air Staff of some portions of the detailed administration of the Royal Air Force, which were previously under his direct control.

The main changes are as follows:

(1) The title of Air Member is given to each of the Members of Council serving in offices held by officers of the Royal Air Force, and the Chief of the Air Staff is described as the first and senior Air Member of Council and principal adviser to the Secretary of State in the direction of the Air Force.

(2) Subject to (1) above, the Air Member for Personnel will be responsible to the Secretary of State for the administration of business relating to the personnel discipline and organization of the Air Force, and the Air Member for Supply and Research (lately Director General of Supply and Research) will, in addition to the business already allocated to him under the previous Order in Council, be responsible to the Secretary of State for the administration of business relating to the equipment of the Air Force.

The Order also provides, having regard to the recent termination of the post of Controller General of Civil Aviation and its replacement by a post of Director of Civil Aviation responsible to the Parliamentary Under Secretary of State, that the Under Secretary of State shall in turn be responsible to the Secretary of State for business relating to Civil Aviation.

The Air Council, as reconstituted, is composed as follows:

Secretary of State and President of the Air Council, Capt. the Rt. Hon. F. E. Guest, C.B.E., D.S.O., M.P.

Parliamentary Under Secretary of State and Vice-President of the Air Council, the Rt. Hon. Lord Gorell, C.B.E., M.C.

Chief of Air Staff and Senior Air Member of Council, Air Chief Marshal Sir H. M. Trenchard, Bart., K.C.B., D.S.O., A.D.C.

Air Member for Personnel, Air Vice-Marshal O. Swann, C.B., C.B.E.

Air Member for Supply and Research, Air Vice-Marshal Sir W. G. H. Salmond, K.C.M.G., C.B., D.S.O., p.s.c.

Secretary, Sir W. F. Nicholson, K.C.B.

Circuit of Great Britain

For the King's Cup, which has been presented by His Majesty the King for a circuit of Great Britain by aeroplane, a number of entries have already been promised, including the following:

The Duke of Sutherland (president of the Air League).

Lieut.-Col. Frank K. McClean (vice-chairman of the Royal Aero Club).

Sir Samuel Instone (Instone Air Line).

Sir Henry White Smith (Bristol Aeroplane Co., Ltd.).

A. V. Roe (A. V. Roe & Co., Ltd.).

H. Scott-Paine (Supermarine Aviation Works).

A. S. Butler (de Haviland Aircraft Co.).

Brig.-Gen. J. G. Weir, C.M.G. (J. & G. Weir, Glasgow).

Col. M. O. Darby (Aircraft Disposal Co., Ltd.).

F. P. Raynham.

In addition to the above, Boulton & Paul, Ltd., of Norwich; Armstrong-Siddeley Motors, Ltd., Coventry; Gloucestershire Aircraft Co., Cheltenham; Aircraft Disposal Co., Ltd., Croydon; Handley Page Transport Co., Croydon; Fairey Aviation Co., Hayes, and Short Bros., of Rochester, are preparing machines for the race.

The race will be a handicap under the Competition Rules of the Royal Aero Club, and the King's Cup will be awarded to the entrant of the aeroplane which first completes the circuit of Great Britain of approximately 850 miles.

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FOREIGN TECHNICAL DIGEST

The New B. M. W. Engines

The Bayerische Motor Works of Munchen have just produced two new engines of the well-known B.M.W. type, best known by the 185-h.p. engine used in making a recent "American" world's record for duration, and so largely used in recent German aircraft.

The new engines both follow the general arrangement of this well-known B.M.W. III.a type.

The engine here illustrated is the smaller of the two. It is rated at 120 h.p., develops 140 h.p. at 1,400 r.p.m., and has a very low fuel consumption for so small an engine. It is known as the B.M.W. II.

The second engine is rated at 240 h.p. and develops 260 h.p. at 1,400 r.p.m. Very great attention has been paid to the reduction of fuel consumption and it is said that it can run on 170 grammes (.375 lbs.) per h.p. hour. This figure sounds highly improbable—the guaranteed figure of 195 grammes (.43 lbs.) is sufficiently extraordinary. This engine—like the earlier 185 h.p. one—is of the super-compressed over-dimensioned type and maintains its full normal output up to an altitude of about 12,000 ft. Owing to the restrictions on the construction of German aircraft and engines, this type may not be manufactured in Germany at present, but doubtless steps will be taken to construct these engines in some other country.

Specification of the New B.M.W. Engines

TYPE B.M.W. II.

Normal power	120 h.p.
Full power (1,400 r.p.m.)	140 h.p.
Number of cylinders	6
Bore	120 m/m.
Stroke	120 m/m.
Weight, dry	210 k.g.
Fuel consumption per h.p. hour	230 g. (.51 lbs.)
Oil consumption per h.p. hour	12 g. (.026 lbs)

TYPE B.M.W. IV

Normal power	240 h.p.
Max. power (1,400 r.p.m.)	260 h.p.
Number of cylinders	6
Bore	160 m/m.
Stroke	190 m/m.
Fuel consumption per B.H.P. hour	195 g. (.43 lbs.)

Petroleum as Power Fuel for Aeroplanes

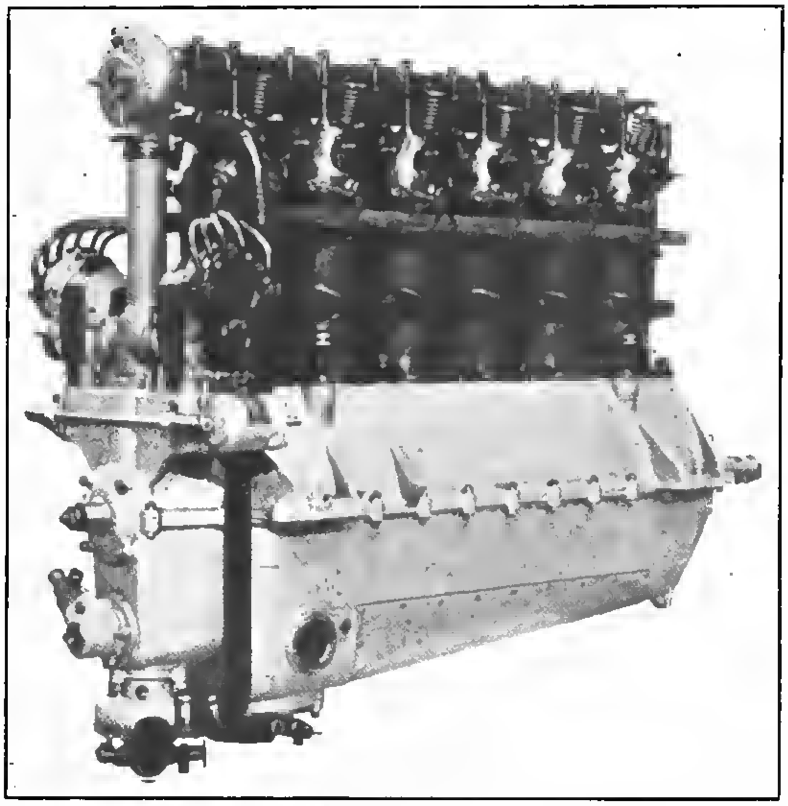
On the 5th of July in Seeland, from the airdrome of Lundteft, near Copenhagen, the first trip in the world took place with an aeroplane which used petroleum as power fuel, a proceeding which, apparently, signifies a landmark in the development of the flight and automobile service. It deals with a petroleum carburetor, an invention of the well-known Dane, Ellehammer. After tests having been made for some time past in the laboratory as well as with an automobile, the carburetor was placed in a Rumpler aeroplane with a 150-h.p. Benz engine. As power fuel ordinary petroleum was used, bought in a nearby shop at 25 cere per kg., while benzine costs 80 to 90 cere. After the petroleum had been poured into the tank, the Rumpler aeroplane went on its trip with flier Johansen for pilot, as well as a workmaster and a civilian flier as passengers. A number of experts were present at the test. It was evident that the engine ran satisfactorily in every respect. It flew just as well as with benzine; the vibration was less and not the least soot formed. There was consumed a smaller quantity of petroleum than of benzine. The carburetor used was only calculated for a 60-h.p. engine, whereas the engine in the aeroplane, as mentioned, was of 150 h.p. The only effect was that the engine had 100 revolutions less per minute; but, in spite of this, the aeroplane flew well. Formerly two ordinary benzine carburetors were used for the feeding of the six cylinders. On account of the result the Danish Air Navigation Company will operate their aeroplane engines with petroleum. According to the statement of the experts, the fuel burns completely, the danger of self-ignition is entirely done away with, as the new carburetor is a so-called dry carburetor. Smell and soot are absent. One may, after this—on account of the more diminished danger of ignition of the petroleum as compared with benzine, benzol, spirit, etc.—expect a revolution in aeroplane and automobile operation. England alone uses yearly engine benzine at a cost of £30 mill. Petroleum costs only one-third.

Meteorological Advice for the Air Traffic

By A. Schmauss—Munich

THE necessity of meteorological advice to the commercial flier is universally acknowledged. Even in the war, where little heed was paid to human life and material, as compared to the conditions of peace time, a wide-spread weather service was organized for the safety of the air service. It has acquired particular importance with the introduction of air traffic.

There are two ways to reach this end: a centralized service of safety and "information sources" organized in sections. Germany possesses so far only the first-



The New B. M. W. Engine

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named part of the organization, the so-called "high strata" information of the Prussian Aeronautical Observatory at Lindenberg. In the early morning a selected series of suitably distributed post or telegraph offices, making use of a code prepared by the Observatory, report on the weather conditions of their localities and the state of the ground, either directly to Lindenberg or via a collecting center. At Lindenberg the reports are examined, supplied and worked out to a "line forecast," thus enabling aeroplanes, starting immediately after the Lindenberg wireless message, to be well informed about the first part of their flight. This supposes, though, that at the time of start there exists a receiver for wireless and specialists are at hand, able quickly to decipher that part of the naturally lengthy Lindenberg message, which is of importance for the respective line.

Now, such a centralized system would suffice if the weather would not change or if the meteorologist on service at Lindenberg was capable of forming a prediction of the coming changes. But this is not the case. If there is no possibility of one general weather forecast, made at one center for the whole of Germany, this is still less feasible with a weather service for air traffic, since the phenomena, of greatest importance for flying, such as fog or thunderstorms, are by nature local ones, and therefore require also an intimate acquaintance with the local conditions. A line may be blocked, according to the 7 A. M. message, by fog, the cessation of which might hardly be timed in advance by the resident observer. If the weather condition is one of "thunder in the air," the control station can but give a warning of precaution, the influence of which on flying work will naturally diminish with growing distance from the service.

Thus we cannot do, in addition to the most serviceable centralized information service, without line assistance, which as yet is very backward in its organization. Let us take, as an example, the so-called "North-South Flight" Berlin—Leipzig-Furth—Munich—Augsburg. At 7 A. M. a number of post offices situated along this line report to Lindenberg (by indirect ways which may remain unmentioned), at 8.10 A. M. Lindenberg issued its statement for this line, together with the reports of the other parts of Germany. We assume that the flight control station at Furth and Leipzig furnish the pilots, starting at 10.15 A. M. for Leipzig and at 10.00 A. M. for Furth—both having to cross a bit of mountain country—with the deciphered data of the part of the wireless, concerning these intervals of the route. Will the pilot feel satisfied with these reports? No; they wish for fresher news and an expert's advice, if possible by word of mouth, particularly if atmospherical conditions of so quick variability are in question, as fog or tendency to thunder storms.

The central meteorological office of Bavaria has tried to fill up this gap by establishing a weather station on the Furth airdrome; but its future is not secured yet, from the financial standpoint, the air traffic companies refusing, to the general surprise, to contribute towards the expenses, though they have declared their readiness to cover the costs of the telegrams necessary for the centralized safety service. As it is customary that traffic lines have to bear all the expenses necessitated for their safety, the Air Companies held that the weather stations on airdromes should be supported by the State or the Community to which the airdrome belongs. We do not wish to discuss this controversy here and wish only to insist on the urgency of meteorological advice being supplied upon the airdromes. It will hardly enhance the feeling of safety on the part of the pilot if, instead of a line forecast issued hours ago at Lindenberg, he receives the advice of a meteorologist familiar with the details of the line, the latter one being able to inquire and receive, by means of the Lindenberg code, special information from particularly perilous portions of the line shortly before starting time—a detail of special importance if this starting time had to be suddenly changed. As the flight is performed by intervals, meteorological advice should also be given accordingly. Practicians may decide to which system they like to give preference; according to my war experience, to me the answer seems to be plain.

Naturally there is no need that such weather stations should do service exclusively for air traffic; if situated in university towns, they can well be annexed to the universities, thus enabling the latter to add to the lectures on meteorology, the practice necessary, and these weather stations might also, in the quality of local centres of forecast, furnish weather information and such like to the papers.

One more important question must be mentioned. How far should the pilot take the weather reports into consideration? First of all, it ought to be made a legal regulation that the pilot is obliged to personally read the weather reports at hand at every aviation field he touches. Practical America has understood it: the insurance companies there do not pay any premiums whenever an accident is to be attributed to the non-heeding of a weather report. To what extent the pilot will give heed to this report is, naturally, dependent on the degree of personal confidence he places in the meteorologist. I cannot approve of an air traffic company saying expressly in their report that on 10 days, for which the weather service had set the forecast "no flying weather," they have fully performed their regular flights. There ought to be a difference made between flying for the sake of sport and the working of a company to whom passengers confide themselves against a remuneration.

When selecting pilots, their meteorological fitness should be taken just as well into account as their technical ability. It should not be tolerated that a pilot should only be acquainted with his aeroplane; he ought also to be familiar with the peculiar properties of his fairway if the meteorological advice is supposed to be of real value.

A New French Flying Boat

On June 10th the first of the new three-engined flying boats intended for the service between Antibes and Ajaccio (Corsica) arrived at the air-port of Antibes. This machine, registered as "L.E.O.6," made the journey from Saint-Raphael, about 25 miles, in 22 minutes, in spite of very unfavorable weather, the pilot being M. Martin.

The machine loaded weighs 8,800 lbs. The central motor is a Salmson 260 h. p., and the other two are Hispano-Suizas of 150 h. p. each, or a total horse-power of 560. The pilot is housed in a small separate compartment by himself with the necessary instruments and wireless outfit, and below him is a spacious cabin seating six passengers. At two-thirds of its full power the speed is said to be 90 m. p. h.

The flying boat, which has been built by Les Etablissments Lioré-Olivier for the Cie. Aéro-Navale, which has the concession for the service between Antibes-Ajaccio-Tunis, was designed largely by M. la Barthe, a director of that line, and after thorough trials will commence its duties between the Riviera and Corsica, where the air traffic is already reaching considerable proportions.

New Fokker Plane Speedy

The Hague.—The Dutch aviator and inventor Fokker, who recently returned from his successful trip to the United States, has just completed two new commercial monoplanes for the Royal Dutch Aviation Company.

The trial flights proved that these monoplanes far surpassed the other Fokker models in efficiency and speed. They can carry a weight of 1,250 kilograms and can fly six hours without landing with six passengers and 200 kilograms of baggage, for which special space is allotted. They are fitted with a Rolls-Royce motor, making an average speed of 160 kilometers per hour.

One advantage of the model is that the whole nose, with the motor and screw, can be detached in a few minutes and replaced by another.

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ELEMENTARY AERONAUTICS and MODEL NOTES

Model Aeroplane Club Activities in Chicago, Washington and New York

The National Scientific Society

THE attempt to form an alliance among the various model-aircraft clubs over the world for the purpose of compiling international standards so that competitions may be carried out on a recognized basis, appears to be heading towards success.

Besides having met with the hearty approval of many men prominent in American aircraft circles, the idea has been spoken of by organizations and individuals as one which bids fair to promote a growth of enthusiasm both among those interested in aeronautics and by the general public.

Having taken the initiative in working towards that goal, the Norsk Aeromodels Klub of Kristiana, Norway, and the Aeronautical Engineering Department of the National Scientific Society (of New York City), have already commenced to formulate laws which, upon completion, will be presented for the approval of those interested in international competitions.

Due to the various classes and kinds of models which have been constructed and presented at competitions, it has become necessary to divide the various classes into groups so that judgment could be rendered on a fair and impartial basis. The following table, having been used successfully by the Norsk Aeromodels Klub, has been approved by the members of the National Scientific Society and is presented to the Model Aircraft clubs for their approval. Suggestions are invited.

Classes	Construction	Hand Launch	Ground Start	Flying after a mark	Circling	Duration of Flight
A. Stick model	*to* 100	40 *meters*	30 *m.*	40 *m.*	½ *Circle*	8 *sec.*
B. Scale model	*to* 100	30 *meters*	20 *m.*	30 *m.*	½ *Circle*	5½ *sec.*

C. Free class.

Class A.—Rubber driven stick models. Standard type. Weight of rubber must no exceed 25 grams and rubber length must not exceed $\frac{\text{span } .85}{100}$

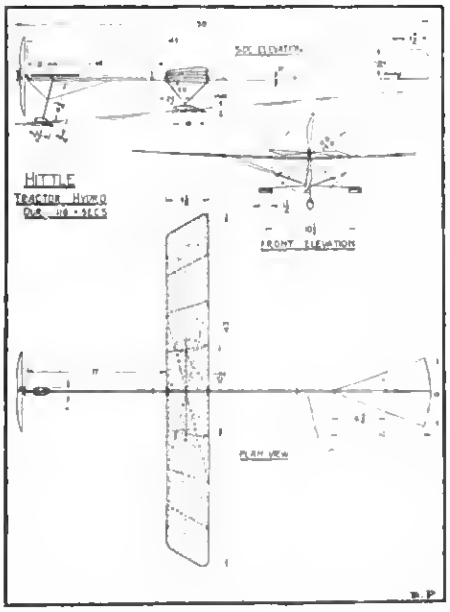
Class B.—Rubber driven scale models. Standard type. A stick in the fuselage wings or landing are mounted is not allowed. Weight of rubber must not exceed 25 grams and length of rubber must not exceed $\frac{\text{span } .85}{100}$

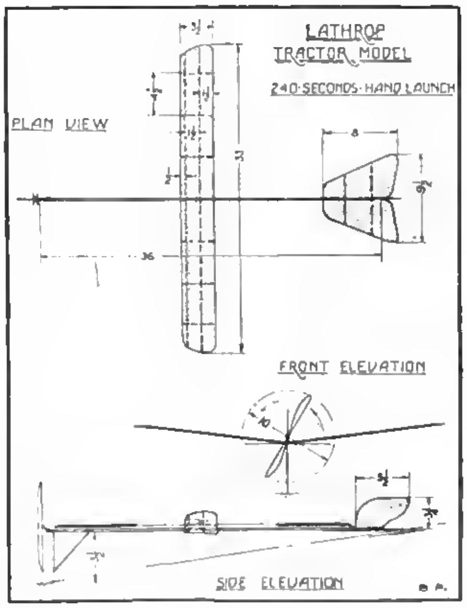
Class C.—Free Class. Record and other models. Power driven.

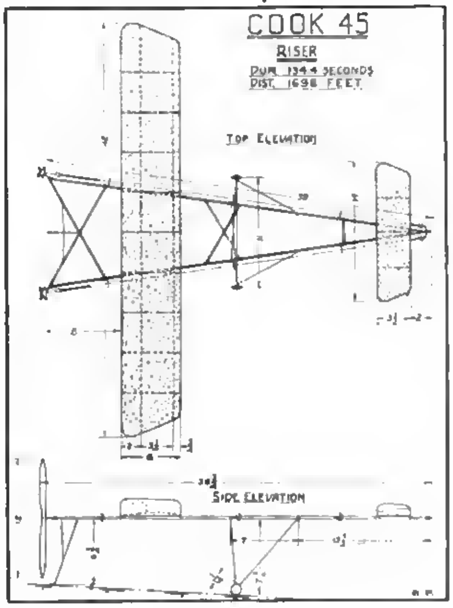
Points

1. *Construction.*—The model can be awarded up to 100 points for good construction, exceptional details, etc.
2. *Hand Launch.*—The model is launched from the hand with a slight push in the direction of flight. The Straight line between the starting point and the point where the wheels touch the ground is measured. The minimum yield is awarded 100 points, and each extreme meter is awarded 2.5 points (Class A) and 3.33 points (Class B).
3. *Ground Start.*—The model is started with a slight push. The model must take the air on a starting cloth measuring 5 meters in length. The distance measured is from the end of the cloth to the point where the wheels touch the ground. The minimum yield is awarded 100 points, and each extreme meter is awarded 3.33 points (Class A) and 5 points (Class C).
4. *Flying After a Mark.*—A circle with a radius of 5 meters is measured on the ground. The model is launched from the hand at a distance of 45 meters from the center of the circle. Landing within the circle brings 100 points. Each meter deficient, brings a deduction of 2.5 points (Class A). If the model is one in class "B" a distance of 35 meters from the circle's center is allowed, and each deficient meter brings a deduction of 3.33 points.
   (The Norsk Aeromodels Klub has chosen to measure to the point where the Model Stops). The National Scientific Society, in view of the fact that it is extremely difficult to control either a rubber power plant or a compressed-air plant to a definite pitch and time, has chosen to disregard the distance beyond the circle, in the case where the model has passed directly over it.
5. *Circling.*—The model is launched from the hand. The object is to have the model fly as many circles as possible. The minimum yield is awarded 100 points, and each extreme ¼ circle is awarded 25 points.
6. *Duration of Flight.*—Time is observed for the practises 2, 3 and 5, the longest duration being valid. The minimum yield is awarded 100 points, each extreme meter being awarded 12.5 and 20 points respectively for Class A and Class B. Time must be measured with the preciseness of 1/10 of a second.

The partakers may make two attempts in every practice and the best result is valid. The starting rules must be strictly adhered to. A faulty or incorrect start may be declared void. The models must not touch the ground between the starting and landing points. A landing must not assume the character of a down fall and circle flying should not degenerate into a spin. In the event that a model is damaged so that repairs are necessary, five per cent is to be deducted from the sum







Three Record-Breaking Models built by members of the Illinois Model Aero Club, described in last month's "Aerial Age"

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of points. All the models in Classes A and B must be furnished with a secured landing-gear.

The foregoing table, compiled by Mr. Harald Gulbrandsen of Kristiana, Norway, applies to models of land planes only. No provision has been made for models of seaplanes or lighter-than-air craft. The members of the N. S. S. are drawing up a set of rules with which, it is hoped, contests for seaplanes and lighter-than-air craft will be encouragged. In the meantime, suggestions are invited. The headquarters of the National Scientific Society are located at Cooper Union, New York City. Mr. J. J. Kuscher is the president.

The Capitol Model Aero Club

Three contests have recently been held by members of the Capitol Model Aero Club at Washington, D. C. While no extraordinary records have been made, the work of the club members has been progressive and is an indication of interesting developments and further progress.

The address of the club has changed from 1726 M St., N. W., to 1210 18th St., N. W., at which place the members have an interesting and comfortahle room. All aeromodellists residing in or around the Nation's Capitol are invited to membership.

Mr. Paul Edward Garber is the president of the C. M. A. C. Mr. Garber is connected with the Division of Mech. Tech. at the Smithsonian Institution, United States National Museum, Washington, D. C.

The Rubber Elastic Motive Power for Models

The use of rubber elastic for the motive power of flying model aeroplanes dates back before the first real flights of man. Choice was not made without good reason, for tests in comparison with all other known sources of power for models placed rubber at the head of the list.

First, let us consider its cost—a really important item, especially for the young experimenter. Compared with the simplest kind of engine, the cost is insignificant. As far as its efficiency as a power-medium is concerned, rubber can absorb a far greater amount of energy, for the same weight of material, than spring steel. because of its greater extension. The handling and "upkeep" of our rubber-motor is extremely simple and economical.

As this source of power has become so widely used, it is well for our experimenters to learn more concerning its natural and mechanical properties, just as the good pilot knows all about the engine he depends on.

Crude rubber is obtained from a large number of different trees, vines and shrubs growing in Mexico, Africa, Java, Sumatra, India, Central and South America. The trees are "tapped" or cut, allowing the milky fluid, called latex, to flow in much the same manner as maple sugar is obtained from the trees in Vermont.

The rubber itself is obtained from the latex by the coagulation process, the principal materials employed being alcohol, acetic acid, air, alum or lime.

Rubber thus obtained in the crude state is purified from mechanical impurities hy washing and drying processes, and its preparation for commercial purposes necessitates the use of filling materials called "fillers." The usual fillers employed are. sulphur, resins, oils, tars, whiting, white lead, talcs, barytes, and clays. Such fillers are used so as to reduce the cost of the rubber without affecting its mechanical properties or usefulness.

Pigments are used in the fillers of colored rubhers, amongst the most used being: lithopone, vermilion, zinc yellow, lamp black, iron oxide, antimony, arsenic and mercuric sulphides, graphite, etc.

Practically all of the commercial rubber is prepared by the vulcanization process, in which the pure or crude rubber is mixed with sulphur and subjected to either heat, acid or cold vulcanization processes.

Crude rubber is a tough, flexible solid, influenced by small changes of temperature, and becoming "tacky" at fairly low temperatures. It melts at about 250° F. and becomes a liquid which does not harden again on cooling. Crude rubber will not dissolve in water or alcohol but dissolves in dilute alkaline solutions, turpentine, petroleum spirits, carbon disulphide and carbon tetrachloride (commonly used in hand fire-extinguishers). Crude rubber is subject to oxidation and it becomes hard and brittle under the prolonged influence of air and light.

Many vulcanized rubbers are affected by the atmosphere and by the action of oils, alcohol, gasoline, etc. They are best stored in a dark place, freely covered with french chalk.

The best grades of rubber have a tensile strength of about 2,000 lbs. per square inch and an ultimate extension of about six times the original length. Good vulcanized rubber can absorb from 500 to 1,000 foot pounds for each pound of its own weight, whereas steel can only absorb from 10 to 20 foot pounds per pound of weight. From this it will be seen why steel springs can never compare with ruhber as a source of motive power.

Flat strands of rubber, ⅛ inch wide and about 1/32 inch thick are the most popular size used for models. It is usually of very good quality, and a piece one foot long may be stretched to seven feet without breaking, after which it will return to its original length.

Increased Lift Obtained with Curved Wing-Tips

An appreciable improvement in lift and "lift-over drift" may be effected over that of the plain rectangular plan-form of wing with parallel section, by suitably shaping the plan form. The end losses due to "inflow" near the upper-surface wing tips and to "outflow" near the lower-surface wing tips may be reduced hy suitably rounding off the wing tips, in plan form, and hy thinning the wing section (or "washing out") in the front elevation.

The most beneficial effects, however, are obtained only after careful study of the distrihutions of air pressure and the employment of proper methods of grading in camber, chord and incidence. The coefficient of drift may he reduced considerably by "washing out" the wing tips.

An examination of the wing forms of fast flying birds reveals the fact that they are graded down to very thin pointed sections at the tips. The incidence angle at the tips is usually either zero or negative in value.

Wind tunnel tests on the effect of the shape of wing tips show that the most efficient tip is in the form of a semi-ellipse. For the most part it is undesirable to have as long a tip as is necessitated by an ellipse, and a semi-circular shape is used to good effect.

Design of Boat Hulls and Floats

Flying boat hulls are designed on the general principles of the fast motorboat and hydroplane, the main object being to "hydroplane," as distinct from ploughing, at as low a water speed as possible. The hull should offer the smallest resistance to water friction and the minimum of wind resistance when in the air. It should be stable, relative to the rest of the machine, when floating, when hydroplaning during the take-off, during alighting and when in the air.

Boat hulls or seaplane floats, aside from the considerations of total lightness of the machine, should be light in weight so the center of gravity will not he too low. A low center of gravity makes a machine very unstable in the air and is difficult to balance at all times.

The hull of a flying boat or the floats of a seaplane should be designed for from 2 to 3 times the weight of the machine ready for flight.

Small Balloons Used to Record Temperature of Altitudes

Pressure and temperature measurements of the upper air are made with sounding balloons, which are small balloons inflated with hydrogen and which carry recording instruments. These balloons are arranged to burst at given altitudes, the envelopes acting as parachutes, breaking the fall of the instruments, so that they reach the ground without injury. An addressed label attached to the instruments offer the finder a reward for its return.

Sounding balloons average from 40 inches to nearly 80 inches in diameter. They rise under the influence of their buoyancy and on account of the diminished external pressure, burst at the altitude determinated upon beforehand.

In this manner records have been obtained for altitudes up to 23 miles, over 121,000 feet.

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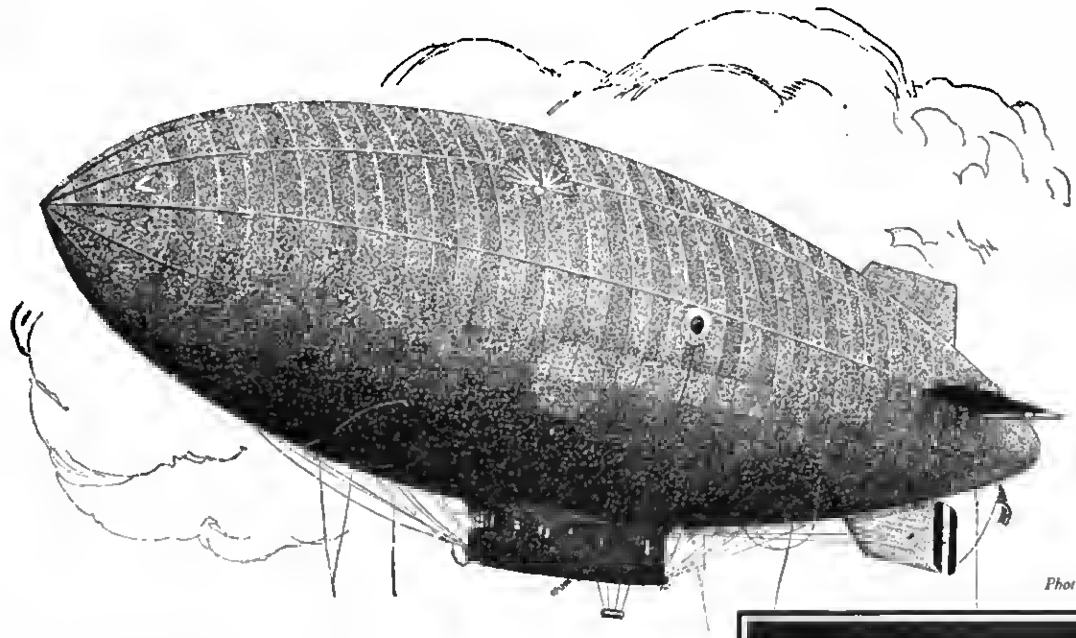

Photo by Goodyear News Service

The latest addition to U. S. Army Dirigible Fleet measures 170 feet long and has a cruising radius of 20 hours, at 65 miles per hour.

The Goodyear AC—

A New Type, Non-Rigid Dirigible

Test flights proved that the unusual contour of the Goodyear A.C., best described as "Squat," was fully justified—the lift of the ship was remarkable, her speed was more than satisfactory.

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"Army and Navy Specifications call for 'Valspar' or 'Equal', and we consider 'Valspar' to be the best varnish for this work. In our long experience as pioneers in the building of airships for both branches of Government Service we have never had a varnish defect, and we attribute that to our use of 'Valspar.'"

Valspar was used on the fins of the Goodyear A. C. and on the exterior and interior of the car, including the aluminum tanks, the fixed and movable control surfaces, instrument board and all metal parts. Durable, waterproof, flexible—Valspar protects wood and metal surfaces from water and weather, vibration, heat and cold.

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The PETREL has been a gradual, certain evolution. During nearly two years of its development careful selections and alterations have been proved by test, and have brought it to its present state of high efficiency.

The PETREL is manufactured by workmen old in the best traditions of aircraft production, and proud of their craft. Every smallest part is selected from the same source, and worked on the same benches, by the same hands, which construct Huff Daland aeroplanes for Army and Navy, under direct government inspection and supervision.

The PETREL has been tested, flown and accepted by the Air Service. It is the only commercial aeroplane in production in this country of which this statement is true. Its simple design, its freedom from wires and turnbuckles, and its rigidly braced fuselage combine to cut maintenance costs to the bone and assure a plane whose correct alignment and absolute rigidity are limited only by its long life. And its superior performance gives you more speed or more distance per unit of power expended than you can get with any other three place aeroplane in existence.

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Weight Empty	1125 Pounds	1215 Pounds
Useful Load	735 Pounds	750 Pounds
Radius	300 Miles	350 Miles
Climb in 10″	4500 Feet	8000 Feet
Ceiling	12000 Feet	18000 Feet
Maximum Speed	90 MPH	110 MPH
Minimum Speed	35 MPH	38 MPH

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(*Concluded from page* 442)

More popular, of course, will be the speed of the planes themselves; for the reason that the non-technical public can visualize the strain under which the bodies and wings are laboring, little thinking that the motor is undergoing the same strain, at the same time putting from four to six hundred times the strength of a horse (if it is a big healthy horse) behind the air screw that sends the machines along at, let us say, somewhere in the neighborhood of 200 miles an hour. Reduced to feet, the speed which the Pulitzer entries are expected to average is 300 feet a second. Now, it is generally known that the muzzle velocity of a .45-calibre bullet is approximately 1,200 feet a second. The Pulitzer planes therefore will fly about one-fourth as fast as a .45-bullet. They will make four times the average speed of the Twentieth Century, passing four telegraph poles in the time the fastest train in America requires to pass one.

What's the use of all this? A proper question and an important one. The question is easily answered. Speed is the main essential of a pursuit plane. Without speed a pursuit ship would have nothing to pursue, due to the fact that an enemy would soon pull out of sight or fly round it in circles until the machine gun found its mark. And the pursuit plane is the most important factor in aerial warfare. The pursuit plane is used for seeking out and destroying the enemy planes, fast or slow; thereby gaining mastery of the air over its sector, and thus being able to protect the slower observation and bombing machines which can perform their duties without fear of interruption.

Every country on earth is developing pursuit machines. The army and navy air forces have not been idle. Still, while foreign nations repeatedly test out their pursuit planes in scheduled Government trials for big prizes, the Pulitzer Trophy Race, which is a civilian contest primarily, affords the only opportunity for the United States Government to determine the relative values of the many experimental types of planes which have been produced in this country during the last two years. All three of our fighting air forces are participating in the Detroit races—the army, navy and marine corps; and each branch without question will know considerably more about its new fighting equipment after October 14th.

(EDITOR'S NOTE.—Colonel Hartney's description of the machines entered in the Pulitzer race will be published in the October number of AERIAL AGE.)

(*Concluded from page* 445)

170 metric horse-power for 10 meters a second, and roughly 4500 horse-power for 30 meters per second. A tunnel of 5000 or more horse-power might well be recommended.

The first cost of such a tunnel would be of the same order as that of the largest airship shed or astronomical observatory. The cost of operating with very high speeds could be limited by choosing a site near the cheapest source of power. The cost does not seem to be prohibitive either to a nation or to a wealthy patron of science.

The question now raised is as to the value to aeronautics of a full scale wind-tunnel for both absolute and comparative tests. If it be considered very desirable, the representatives of aerodynamics might do well to indicate its advantages. For if the tunnel should appear to be of sufficient importance, the planning and paying for it would perhaps not offer very formidable difficulties. One on a continent would suffice for the present. Various engineers with whom I have discussed the need for a full-scale tunnel are of the opinion that it

(*Concluded on page* 478)

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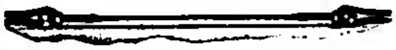

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(*Concluded from page* 474)

would be more useful to mankind than another great astronomical observatory, or mammoth airship shed. In fact a large airship shed might be used as the housing for such a tunnel till its permanent value could be ascertained.

A full-scale tunnel would have some obvious advantages. It would furnish a uniform wind throughout the year, irrespective of weather or season. Models and full-scale craft or parts thereof, whether inherently stable or unstable, could be held steady at any attitude to the wind undisturbed by gravity or gusts. The measurements of forces, moments, pressure distributions, flow distributions, could be made under constant conditions and with stationary instruments. Similar models varying greatly in size could be used, thus enlarging the range of vl/D. The effect of varying the surface texture, or structural details of full-scale craft, and the effect of ageing and distortion, could be studied. Laws of comparison between models and full-scale craft could be more exactly established when needed, and in some cases dispensed with by putting the actual ships to direct test.

If an international committee is to consider methods of experimentation, laws of comparison, and forms of expression, it might well include within its scope not only the work of ordinary wind-tunnels but also that of a compressed air tunnel, a full-scale tunnel is possible, and actual flight tests.

(*Concluded from page* 453)

Such a city as Monmouth, with its spirit of co-operation and enthusiasm for aviation, is a good place in which to manufacture aeroplanes. Negotiations are right now under way to bring to Monmouth the factory of a ship which is destined to be popular.

Detroit was just such a city when the automobile was in the same stage as is aviation today, and the man lacks vision who says that aviation is not destined to be as great an industry as is the automobile today.

(*Concluded from page* 455)

The introduction of twelve-volt ignition has been a distinct step in advance. Even with the poor batteries which were known to have deteriorated in storage, ignition troubles were practically eliminated. The addition of all the weights to the engine has more than been compensated for by the reduction in the weight of the spares to be carried.

As a general result of the winter work, the Commander of the Air Squadrons is convinced that the improvement in material is such that the time is fast approaching when forced landings and delayed starts can no longer be blamed on material but the responsibility therefor can be placed squarely up to the operating personnel.

The alterations and changes in the Liberty engine which have been effected were under the direction of Lieutenant-Commander S. M. Kraus, and Lieutenant B. G. Leighton of the Bureau of Aeronautics and letters commending their work in this connection have been addressed to them by the Chief of the Bureau.

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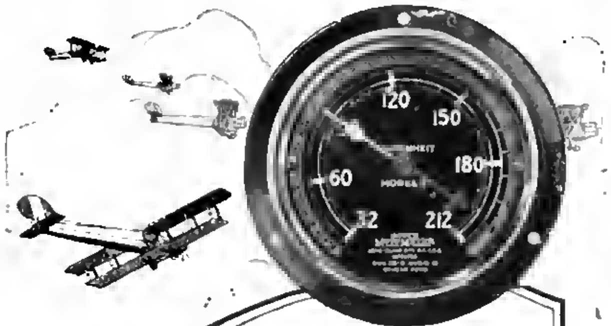

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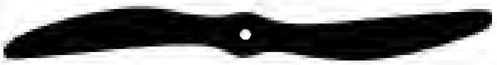

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TABLE OF CONTENTS

CHAPTER
I Review of Commercial Aviation During the Year—Aircraft Demonstrate Practical Utility—Significance of Aircraft Battlesbip Demonstrations—Air Law in Sight—Aeronautical Chamber of Commerce Organized..........
II Problems of Aerial Transportation—Capital, Terminals, Reliability—Needs Wbicb Can be Met Through Aerial Law—Report to Secretary of Commerce on Safety in Flight.......
III The Air Demonstrates Its Command of the Sea—The Battleship Bombing and Conference on the Limitation of Armaments..........
IV Review of Aeronautics Throughout the World, Nation by Nation.................
V Technical Progress in Aircraft Construction During the Year.........................
VI Airships in Commerce.....................
HISTORICAL DESIGN SECTION...............

APPENDIX

Commercial Section: Aeronautical Chamber of Commerce of America, Inc.; Manufacturers Aircraft Association, Inc.

U. S. Air Service, War Department: Organization; Officers on Duty in Washington; Army Corps Areas and Departments; Stations and Activities.

Bureau of Aeronautics, Navy Department: Organization; Officers on Duty in Washington; Officers with the Fleets; Naval Air Stations.

Marine Corps, Navy Department: Organization; Officers; Aviation Stations.

Strength of U. S. Air Forces (Army, Navy, Marine Corps); Diplomatic Service of the U. S.; Air Attaches, War Department; Air Attaches, Navy Department; Diplomatic Service to the U. S.: Foreign Air Attaches; Aeronautical Board; Personnel and Committees; Helium Board; Board of Surveys and Maps, Department of Interior.

Aircraft Appropriations, Foreign; Aircraft Appropriations, U. S.; Military; Naval; Postal; Aircraft Production Cost, 1917-1918; Foreign Subsidies for Civilian Aviation; Armament Conference Report on Aircraft.

Air Mail Service, Post Office Department: Executives; Air Mail Fields; Transcontinental Controls; Planes in Service; Consolidated Statement of Performances, May 15, 1918—Dec. 31, 1921; Forest Fire Patrol, Department of Agriculture; National Advisory Committee for Aeronautics; Organization; Summary of Report; President's Letter of Transmittal; Customs Regulations, Treasury Department; Public Health Service, Treasury Department; Aircraft Imports and Exports; Bureau of Standards, Department of Commerce; Bureau of Foreign and Domestic Commerce, Automotive Division, Department of Commerce; Air Law Section: Wadsworth Bill, creating Bureau of Civilian Aeronautics in Department of Commerce; Fake Stock Warning, National Vigilance Committee; Associated Advertising Clubs of the World; Aircraft Insurance; National Aircraft Underwriters Association; Colleges and Schools Offering Courses in Aeronautics; Landing Fields and Air Terminals; Chronology for 1921; Remarkable Aeronautical Performances, 1920; World's Records, 1921; Trade Index.

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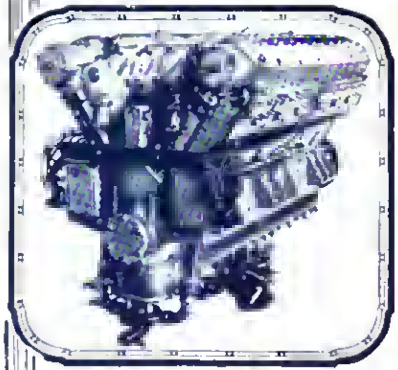

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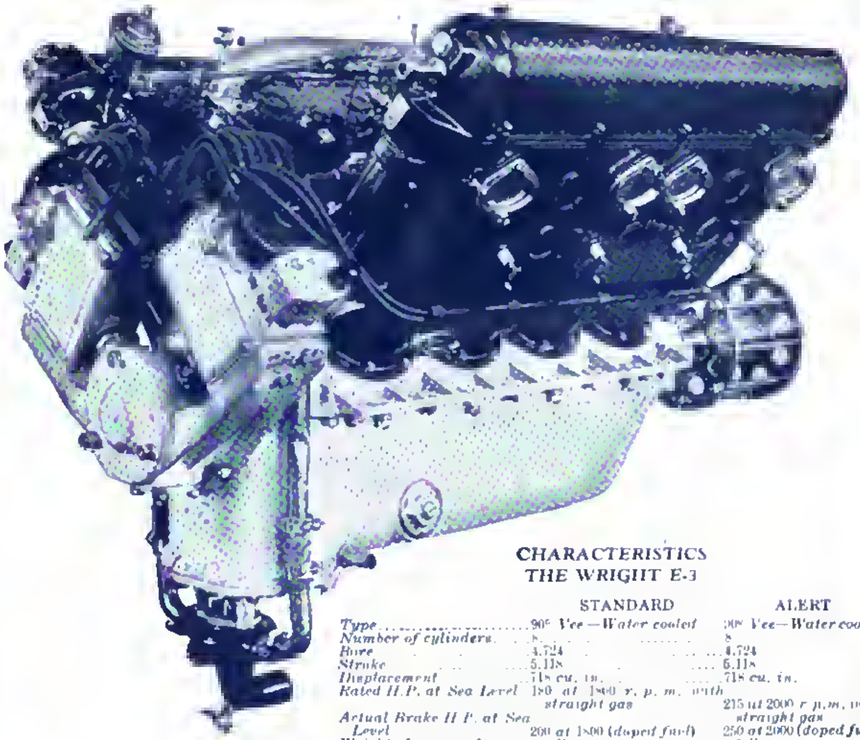

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Fuel Consumption (lbs. per H.P. Hr.)	.48	.48
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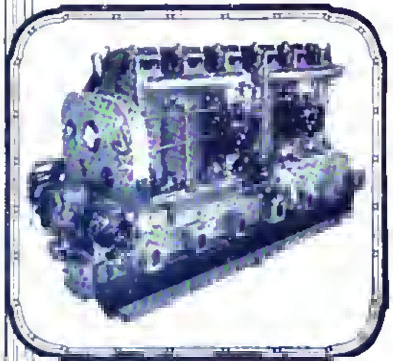

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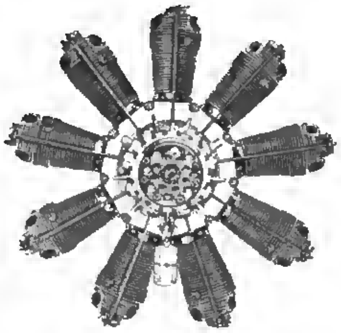

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BRITISH AIR MINISTRY TYPE Test, September, 1922

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FRENCH AIR MINISTRY TYPE Test, JUNE, 1922

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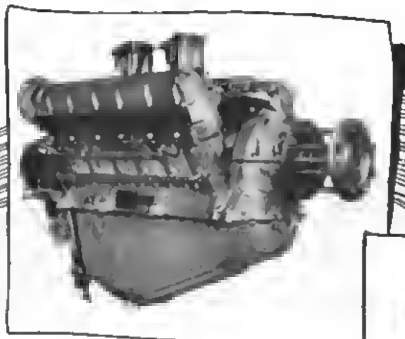

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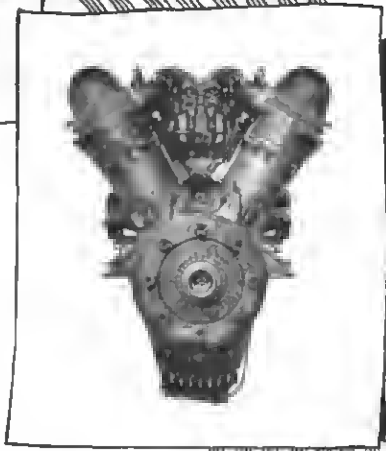

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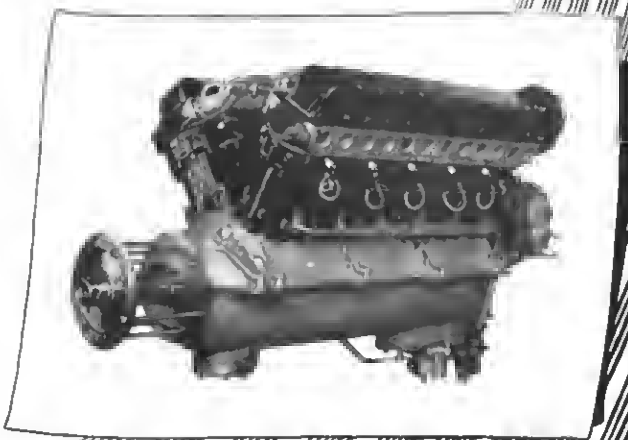

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The Detroit Races

ENTRIES ASSURE GREATEST AERONAUTIC EVENT ON RECORD

PRESIDENT Harding has expressed his appreciation of the national importance and significance of the Second National Aero Congress to be held in Detroit and the National Airplane Races to be held at Selfridge Field, Mt. Clemens, October 12, 13, & 14. Howard E. Coffin, Chairman of the National Committee on Organization received the President's letter. It reads:

"I have many times given expression to my interest in the development of aviation. I fully realize the influence which this newest and speediest means of transportation and travel is destined to exert upon civilization.

"Aviation's vitally important part in the general scheme of our own national defense is already well recognized. A strong and healthy commercial aviation development is a prerequisite to all adequate plans involving our national security and welfare.

"Therefore, it is with the greatest satisfaction that I extend to the Detroit Aviation Society and, through your committee, to the National Aeronautic Association my sincere appreciation of the objects you are seeking and my best wishes for the complete success both of the October contests and of the national convention to be held coincident therewith."

Sincerely yours,
(Signed) Warren G. Harding

Fifty-five entries have so far been confirmed in the principal contests for the national races. The large number of entries and the unprecedented preparations being made to accommodate the thousands at Selfridge Field will make the National Airplane Races the greatest and at the same time the most thrilling event in the annals of sport, officials assert.

Delegates from more than sixty cities have made reservations for the air convention.

The Curtiss Marine Flying Trophy Race will be held on October 7th. More than a dozen seaplanes and flying boats have been entered so far in this over-water classic which is the premier event in marine aviation.

On October 12, 13 & 14 a series of races for overland planes will be held, chiefly among them being the PULITZER TROPHY RACE, the speed classic of the world. To date there are twenty-four entries for the Pulitzer contest. It is believed these entries will break the world's record made in last year's Pulitzer race.

All the Executive and Administrative branches of the Government have endorsed these events, the Army, Navy and Marine Corps having entered their latest and fastest planes. Other races will be held for large multi-motored planes, light commercial machines and 2-passenger observation planes.

In all, $10,000 in money prizes and $30,000 worth of gold and silver trophies will be awarded.

On the dates of the races for overland planes the Second National Aero Congress will convene. Delegates are being appointed from more than 60 cities in the United States. They will come to Detroit principally to organize a permanent national aeronautic association.

Aviation is the new great arm of the national defense and all Americans are vitally interested in this powerful weapon. Then, too, the science of flight is the new medium of travel and transport.

The national aeronautic association will represent all Americans, represent their thought and echo their voice in the halls of the municipal, state and national legislatures.

The delegates to the Second National Aero Congress will draft the constitution and by-laws of this representative organization. Representatives of the National Air Association and the Aero Club of America are co-operating with the advance committee of 500 prominent men in the initial work incident to the organization.

The principal national business to come before the delegates will be the drafting of a program to hasten the adoption of federal air laws and the formation by act of Congress of a bureau of civil aeronautics in the Department of Commerce.

Need for Air Laws

For three or four years Congress has had many measures under consideration, legislation which would place civilian flying under Federal jurisdiction.

The U. S. Army Air Service, the Naval Bureau of Aeronautics and the U. S. Air Mail Service are functioning with an efficiency approximating 100 per cent. They are credited with far-reaching developments in military and naval aerial operations; and are the equal, in many respects superior, to similar air forces abroad. But the military and naval air forces are not handicapped by lack of jurisdiction. Each has its highly trained executive and specialized personnel. That fact accounts for the prestige of American service aviaton to-day.

With civilian aviation it is different. If the public has lost sight of the peaceful attributes of aircraft, it is due for a change of vision. A means of transport which carried more than 150,000 pounds of parcel freight and approximately 250,000 passengers last year must eventually attract sufficient public attention to penetrate the halls of Congress.

Civilian operators, designers and financial supporters of aviation urge the Government to do something to create Federal supervision over civilian flying. For several months this nation-wide demand has been expressed in the Wadsworth bill.

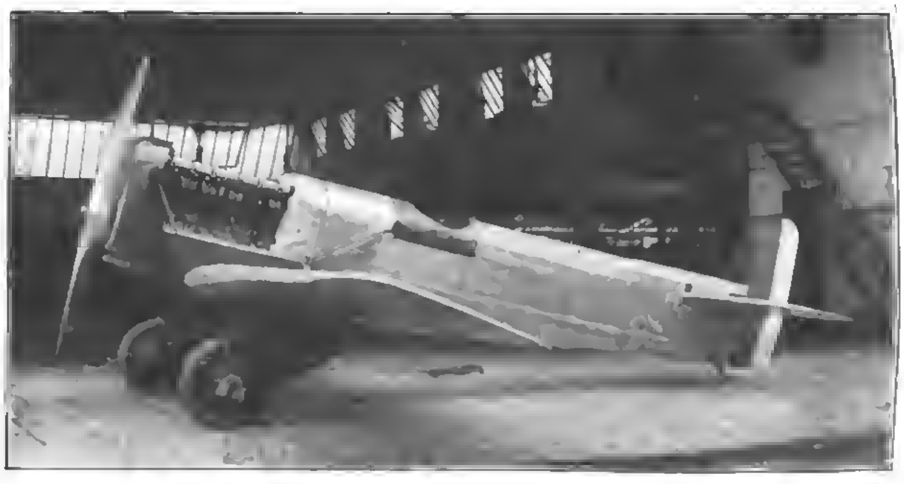
The bill was endorsed by everybody when it was first introduced in the Senate and passed last February. All who had considered the problem approved it; Mayors, State legislatures, flying clubs, State aviation committees and the manufacturers and operators of aircraft. In fact, the aircraft industry is the first infant industry to go on record as desiring to have itself regulated.

Everything Regulated Except Aviation

Operators and constructors have been twixt the devil and the deep blue sea, in a manner of speaking. They have not been controlled by national authority in any form; and after all, control is synonymous with protection. To-day anybody can fly in any sort of an old crate without a license. In a country where one requires a license to hunt, marry, keep a dog, build a house or dig a tunnel, one can do anything he wants to in the air without first qualifying for his job or making his flying machine airworthy.

More than ninety per cent of the aircraft accidents are caused by irresponsible persons operating unairworthy machines. It has led to many serious accidents and has kept capital out of commercial aviation, the sort of aviation that is needed if we are to develop aerial transport facilities to a point where they shall provide an adequate reserve which our excellent Army and Navy air forces may draw upon in an emergency. The Wadsworth bill has been in the House Committee on Interstate and Foreign Commerce since last February. Why it has not been brought out and acted upon, nobody knows.

Meanwhile the aviator is a potential outlaw. For if he damages another's property, falls on him or with him, tears up the grass on a courthouse lawn, in fact, if anything happens that the party of the first part, to wit, the plaintiff, believes should not have happened, the pilot can be prosecuted under the common law, without aerial law, license or legal prerogatives to protect him. Airmen desire wise and strict laws to protect the public, their foolish and erring brethren and themselves. They know their insurance rates will then be reduced.



The Loening Racer, designed by Grover C. Loening.

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Oct. 10—MEDICAL SUPPLIES—New York City, Auction. For catalog write Surplus Property Sect., Office, Surgeon General, Washington, D. C.

Oct. 11—AIR SERVICE SUPPLIES—Carlstrom Field, Fla., Auction. For catalog, write commanding Officer, Carlstrom Field, Fla.

Oct. 17—Q. M. SUPPLIES—Camp Dix, N. J., Auction. For catalog write Q. M. S. O., 1st. Ave. & 59th. St., Brooklyn, N. Y.

Oct. 19—POWER HOUSE EQUIPMENT—Rock Island, Ill., Sealed Bids. For catalog, write C. O., Rock Island Arsenal, Rock Island, Ill.

Oct. 24—AIR SERVICE EQUIPMENT—Montgamery, Ala., Auction. For catalog write C. O., Air Reserve Depot, Montgomery, Ala.

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ARTMENT

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Rates are now prohibitive.

The aviator points to the motorist who at first fought highway laws, but who now earnestly supports them.

All the great Powers have national air laws except the United States. The Canadian Air Board prohibits flying where the pilot has not been licensed or his plane registered. Pilots are examined and their machines inspected periodically. American pilots are automatically barred from flying over Canadian territory because they are not licensed in this country. The Canadian Air Board, however, has courteously extended permission to our Army and Navy aviators on the grounds that their record proves rigid training and general efficiency.

Races Over Canadian Waters

Two of the courses in the National Airplane Races at Detroit extend over Lake St. Clair, part of which is Canadian territory. Due to our lack of national air laws and the Canadian proscription against our hit and miss civilian flying, civilian entries in the races would be barred.

The Canadian Air Board has been requested to lift the ban for the purpose of the races. Meanwhile strong representations will be made at the Aero Congress asking the legislative branch of the American Government to remedy the situation by the immediate passage of the Wadsworth bill.

The Aero Congress alone would be important, from the national viewpoint, but the National Airplane Races will attract thousands of visitors to Detroit. Official observers are being sent by foreign Governments.

They know that the Army, Navy and Marine Corps air forces, as well as many civilian constructors, have developed nearly forty different types of airplanes in the last two years. The races afford the first opportunity to test these machines under conditions which will disclose their qualities of speed, endurance and all-around efficiency. It is believed that several records will be made as more than a dozen machines are being built for an average speed of 200 miles an hour over a closed course of 160 miles. Several planes are being secretly built, their general specifications remaining a mystery until the rules of the race force the constructors to describe them in official entry blanks.

The Pulitzer Trophy Race, while a contest for the fastest land machines, will be held over a triangular course of 40 miles to a lap (4 laps, or 160 miles) the entire course being over the waters of Lake St. Clair, with the exception of the starting and finishing point at Selfridge Field, Mt. Clemens, Mich., where a monster grandstand is being built to accommodate the thousands who usually attend national sporting events. The National Airplane Races this year will be as important as the national motor car races in early days because they will bring out the qualities and defects in the various flying machines. Which is another reason why foreign Governments are watching this year's event so closely.

Notes on Navy's Entries for Detroit Races

Curtiss Marine Trophy Race

Type VE-7H is the standard Vought two-seater advanced training plane now used by the Navy as an observation plane and fitted with a pontoon. This airplane was designed and built by Mr. Chance Vought in 1918 and is supplied as standard equipment to the Atlantic and Pacific Fleet Air Squadrons as a single-seater land plane for combat training, as a two-seater land plane for general observation duty, and as a two-seater seaplane as an observation plane to be carried aboard ship. Vought planes of this type are now on board the MARYLAND and have been successfuly launched from the MARYLAND'S catapult. The Wright E-3, 8 cyl. engine is a modification of the standard 180 H. P. E-2 engine made by the same firm, the modifications consisting essentially in high compression pistons, high lift cams and other alterations which permit the engine to develop between 220 and 240 H. P. at 2,000 revolutions. The high compression E-3 engine is designed for blended fuel.

The HA is a Curtis designed and built seaplane brought out in 1918 as an answer to high performance German seaplanes which were interfering with the bombing operations conducted against the German submarine bases on the Belgian coast. The problem was to develop a fast two-seater seaplane using a single Liberty engine. Due to change in conditions the HA type was never put into production, and the sample plane tested in 1918 has been reconditioned and entered in the Curtiss Marine Trophy Race, sion Liberty is a standard Liberty engine Liberty engine. A special high compres- but fitted with a special high compression with high compression pistons and new valves and should develop over 420 H.P. on blended fuel. The machine was designed by Mr. W. L. Gilmor of the Curtiss Aeroplane & Motor Corporation in cooperation with Major B. L. Smith, U. S. Marine Corps.

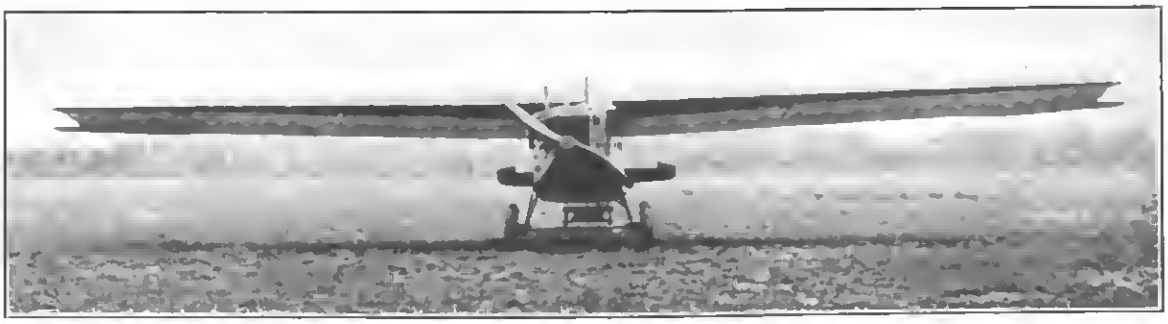
The H-16 is a standard twin Liberty engined flying boat used during the War both by the American and British Navies for submarine patrol and convoy duty. The plane was designed by Mr. G. H. Curtiss and built by the Curtiss Aeroplane & Motor Corporation in 1916. The Navy Department has a large number of these planes on hand and the one entered in the race is standard in all respects except that the Liberty engines have been provided with special high compression pistons. The H-16 will be flown from the Naval Aircraft Factory to Detroit for the race, following the Hudson River, the Lakes of New York State to the Great Lakes.

The D-4 is a tractor biplane designed by Mr. Edson Gallaudet and built by the Gallaudet Aircraft Corporation in 1918. It was built for the Navy as a high speed two-seater seaplane making use of the Gallaudet gear drive. It is believed to be the only gear driven plane in the country and is of considerable technical interest for this reason. It is fitted with a single Liberty engine mounted in the fuselage, which drives by means of a ring gear a propeller which is situated immediately behind the wings. The fuselage or tail structure of the airplane extends through the center of the ring gear carrying the propeller.

Model 18-T tractor triplane was designed by Mr. C. B. Kirkham and built in 1918 by the Curtiss Aeroplane and Motor Corporation as a two-seater combat plane of maximum performance. Had the War continued it is likely that this type would have been put into production for use on the Western Front. As it was, the sample plane made on trials a high speed of 162 miles an hour which was then a world's record for any type of airplane and is still believed a world's record for a two-seater fighting machine. For the purpose of the Curtiss Marine Trophy Race two of these airplanes which were in store have been reconditioned and fitted with pontoons to convert them to seaplanes. They are fitted with the Curtiss CC-12, 400 H.P., a light 12-cylinder engine especially designed for this airplane. These triplanes are believed to be the only triplanes in the country and are of considerable technical interest on this account.

The UO-1 is a new type of Vought observation seaplane, being developed by the Chance Vought Corporation for the Navy Department as a replacement for the standard VE-7 Vought now used on ships for catapult launching. The plane is equipped with the new Aeromarine 250 H.P. engine which presents a new feature in aeronau- light 12-cylinder engine especially designed der heads.

Types TS-1 and 2, and TR-1 and 3 are variations of the Navy shipboard combat plane type TS as designed by the Design Section of the Bureau of Aeronautics and



The Fokker Transport, Entered by the Army in Event No 3.

built at the Naval Aircraft Factory. The TS planes were designed to give the smallest and most compact plane with the maximum facilities for take-down and erection aboard ship. All wires and turnbuckles in the wing bracing are eliminated to facilitate rapid erection. The fuel tank is carried in the lower wing and is made detachable so that in case of fire, due to an incendiary bullet, the pilot can pull a release which will drop the tank and its inflammable contents clear of the machine. Another unique feature is the provision of interchangeable landing gears so that the TS planes may be used with land wheels as an ordinary land plane, or with twin pontoons as a seaplane depending upon the service required. The TS-1 is equipped with a new Lawrence air-cooled radial engine rated at 220 H.P. This is the last word in air-cooled engine development and the Race is considered an excellent place to give this engine a severe try-out. The engine has been developed for the Navy especially for the problem of shipboard airplanes where minimum weight and the greatest simplicity are prerequisites. The TS-2 is the same plane equipped with the Aeromarine 240 H.P. engine. The TR-1 is the same TS plane provided with a Lawrence air-cooled engine, but given special racing wings, and the TR-3 is the same as the TR-1 except that Wright E-2, 220 H.P. engine has been substituted. These four planes constitute then a full-scale experiment of the greatest technical interest to the Navy, using three different engines and two different designs of wing. The occasion of the Curtiss Marine Trophy Race has been used to try out these design modifications under competitive conditions. The planes include a maximum of new and advanced features both in engineering and aerodynamics, and it is believed that the race between these four planes is secondary in interest only to the race for the Curtiss Marine Trophy for which they will compete.

Pulitzer Race

The CR biplanes are well known since one of them piloted by Mr. Bert Acosta won the race for the Pulitzer Trophy at Omaha last year making a speed of 176-7 miles per hour, the World's Record for a closed course. The same plane tried over a straightaway has made 197.8 miles per hour which is an American speed record if not a World's Record for straight flight.

The CR type was designed by the Curtiss Aeroplane & Motor Corporation in cooperation with the Navy Department and built by that corporation in an effort to produce an airplane with the maximum aerodynamic refinement. The CR planes are equipped with a Curtiss 12-cylinder, 400 H.P. engine which is still a relatively new engine developed by the Curtiss Company for the Navy Department, but not yet in general service use. The information obtained by testing this engine in races is being applied in the form of modifications to the sample engine, before such engines are adopted for general service. The CR machine, as the present title holder, is of course the favorite based on past performance. It is the first airplane in this country to have attained speeds above 190 miles and it is due largely to the special wing construction adopted that no difficulties were experienced. Abroad in connection with racing there has been a succession of wing failures in the air largely due to fabric tearing loose under the action of terrific pressures generated at these speeds. However, the CR plane has its wing covered with plywood to which the fabric covering is glued and ironed in place so that there is no possibility of it working loose.

The BR type airplanes are designed by Messrs. Booth and Thurston of the Aerial Engineering Corporation, Hammondsport, N.Y., who a year ago were employees of the Curtiss Aeroplane and Motor Corporation and worked on the design of the CR plane. Therefore, it may be concluded that the BR will incorporate a good deal of the experience of the CR type. The BR represents an attempt to take another step in the matter of aerodynamics refinement suppressing completely the structural bracing required by wings of a biplane by the use of an unbraced monoplane wing. In addition, there is a retracting land gear by which the entire landing gear is retracted into the body of the fuselage once the plane is in the air so that in flight only the fuselage and wings present resistance to the air. These are radical innovations in the art of airplane design and if successful should materially increase the speed that airplanes are capable of making today. A further innovation of a frankly experimental character has been tried on one of the BR planes and this is the complete suppress on of the radiator which all water-cooled engines have to have carried for them. This is done by covering the entire wing with a thin sheet of copper under which the water circulates so that the wing itself becomes one large radiator performing the double function of cooling the engine and supporting the weight of the plane. If it be proved possible by the gruelling conditions of a race to cool the engine developing its ultimate maximum of power a very important advance in aeronautical engineering will have been made. In general, the BR air planes represent in their design and construction not only the last word in refinement, but three radical innovations in design which, if successful, will have a profound influence on the future design of high performance military and navel airplanes. The BR planes are fitted with the Wright H-3 special high compression engine developing 400 H.P.

The MB-7 is a tiny monoplane designed and built for the Navy by the Thomas-Morse Company for the Pulitzer Race of last year and, although this little airplane did not finish the race due unfortunately to a forced landing in which Col. Hartney, who was flying the plane for the contractor, was injured, it nevertheless gave a very good account of itself and it is proposed to enter the machine again in this year's race. The MB-7 is equipped with the special 400 H.P. Wright H-3 engine that is also used in the BR plane. The MB-7 does not present any radical features, but is a conventional monoplane of the very minimum size to carry this large engine and speed is obtained by a low power-weight ratio.

No. 1.

Many Entries For Event

Curtiss Marine Flying Trophy

VE-7H Tractor Biplane VA Class

Span—upper and lower—34' 1⅜"
Length—30' 1"
Height—10' 2"
Chord—4' 7½"
Gap—4' 8"
Angle of Incidence—Upper 1° 45'. Lower 2° 15'.
Dihedral—1° 15'
Wing Area—284.5sq. ft.
Aerofoil Sec. R.A.F.—15
Gross Weight—2175
Maximum Speed—120

Engine—Wright E-3. 220 H.P.

Designed—by Mr. Chance Vought.

Built by Chance Vought Corporation.

Pilot: H. A. Elliot, Lieutenant, U.S.N.

TS-2 Tractor Biplane VF Class

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6¾"
Chord—4' 9"
Gap—5' 6"
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft.
Aerofoil Section—USA—27
Gross Weight—2085
Maximum speed—130

Engine—Aeromarine U—8—D, 240 H.P.

Designed by Design Section. Bureau of Aeronautics, Navy. Department. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.
Pilot: H. J. Brow, Lieutenant, U.S.N.

TS-1 Tractor Biplane VA Class

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6¾"
Chord—4' 9"
Gap—5" 6'
Angle of Incidence—0
Dihedral—3° (Lower wing only)
Wing Area—225 Sq. ft.
Aerofoil Section—USA—27
Gross Weight—2025
Maximum Speed—125

Engine Lawrence J—1, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept., (Comdr. Hunsaker)

Built by Curtiss Aeroplane & Motor Corpn.

Pilot: S. W. Callaway, Lieut. (jg) U.S.N.

TR-3 Tractor Biplane VF Class

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6¾"
Chord—4' 9"
Gap—5' 6"
Angle of Incidence—0
Dihedral—3° (lower wing only)
Wing Area—225 sq. ft
Aerofoil Section—Mod. RAF—15
Gross Weight—1980
Maximum speed—130

Engine—Wright E—3, 220 H.P.

Designed by Design Section, Bureau of Aeronautics, Navy Dept. (Comdr. Hunsaker).

Built by Naval Aircraft Factory.

Pilot: D. Rittenhouse, Lieutenant, U.S.N.

TR-1 Tractor Biplane VF Class

Span—upper and lower—25' 0"
Length—24' 7"
Height—9' 6¾"
Chord—4' 9"
Gap—5' 6"

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Angle of Incidence—0
Dihedral—3° (Lower wing only)
Wing Area—225 Sq. ft.
Aerofoil Section—Mod. RAF—15
Gross Weight—1790
Maximum Speed—130
Engine Lawrence J—1, 220 H.P.
Designed by Design Section, Bureau of Aeronautics, Navy Dept., (Comdr. Hunsaker)
Built by Naval Aircraft Factory.
Pilot: A. W. Gorton, **Lieutenant, U.S.N.**

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HA Tractor Biplane VF Class
Span—upper and lower—42' 0"
Length—30' 9"
Height—11' 5"
Chord—6' 2"
Gap—6'
Angle of Incidence—0
Dihedral—0
Wing Area—490 sq. ft.
Aerofoil Section—Sloane
Gross Weight—3906
Maximum speed—135
Engine—Liberty Special H.C., 420 H.P.
Designed by Curtiss Aeroplane & Motor Corp. (Mr. W. L. Gilmor)
Built by Curtiss Aeroplane & Motor Corporation.
Pilot: A. J. Williams, Ens., U.S.N.

H-16 Tractor Biplane VP Class
Span—Upper 95' 1", Lower 68' 11"
Length—46' 2"
Height—17' 9"
Chord—7' 1"
Gap—8' 1"
Angle of Incidence—4°
Dihedral—1°
Wing Area—1164 sq. ft.
Aerofoil Section R-14—6
Gross Weight—10000
Maximum Speed—100
Engine—Liberty Special H. C., 420 H. P. engine
Designed by Curtiss Aeroplane & Motor Corpn. (Mr. G. H. Curtiss)
Built by Curtiss Aeroplane & Motor Corp.
Pilot: R. Irvine, Lieutenant, U. S. N.

— — — — — —

D-4 Tractor Biplane VF Class
Span—Upper, 46' 5", Lower 45'
Length—33' 6"
Height—11' 8"
Chord—7'
Gap—7'
Angle of Incidence—2° 10'
Dihedral—0
Wing Area—620 sq. ft.
Aerofoil Section RAF—15
Gross Weight—5440
Maximum speed—135
Landing speed—55
Trial Report—No. 5, dated Feb. 1919.
Engine—Liberty Special H.C., 420 H.P.
Designed by Gallaudet Aircraft Corp. (Mr. Edson Gallaudet)
Built by Gallaudet Aircraft Corp. (about first of 1918)
Pilot: W. K. Patterson, Lieutenant, U.S.N.

18-T Tractor Triplane VF Class
Span—Upper, Lower and Middle—40' 7½"
Length—28' 3⅞"
Height—12'
Chord—3' 6"
Gap—Upper 3' 6", Lower 2' 11"
Angle of Incidence—2½°
Dihedral—0
Wing Area—400 sq. ft
Aerofoil Section—Sloane
Gross Weight—3972
Maximum Speed—140
Engine—Curtiss C-D-12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corpn. (Mr. C.B. Kirkman)
Maximum Speed—120
Wing Area—284.4 sq. ft

Lt. O. G. Kolly, who will pilot the Fokker Transport

Aerofoil Section—RAF—15
Gross Weight—2175
Built by Curtiss Aeroplane & Motor Corp.
Pilot: T. B. Lee, Lieutenant, (jg) U.S.N.

— — — — — —

18-T Tractor Triplane VF Class
Span—Upper, Lower and Middle—40' 7½"
Length—28' 3⅞"
Height—12'
Chord—3' 6"
Gap—Upper 3' 6", Lower 2' 11"
Angle of Incidence—2½°
Dihedral—0
Wing Area—400 sq. ft.
Aerofoil Section—Sloane
Gross Weight—3972
Maximum speed—140
Engine—Curtiss C-D-12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corp. (Mr. C.B. Kirkman)
Built by Curtiss Aeroplane & Motor Corporation.
Pilot: L. H. Sanderson, 1st Lieut. U.S.M.C.

UO-1 Tractor Biplano VO Class
Span—Upper 34' 1⅜", Lower 34' 1⅜"
Length—29' 3"
Height—10'
Chord—6'
Gap—4' 8"
Angle of Incidence—0
Dihedral—0
Wing Area—308 sq. ft.
Aerofoil Section—Albatros.
Gross Weight—2608
Maximum Speed—130
Engine—Aeromarine U—873, 250 H.P.
Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
Built by Chance Vought Corp.
Pilot: M. A. Mitscher, Lieut. Comdr. U.S.N

Navy Entries For Event No. 4

VE-7-H Tractor Biplano VA Class
Span—Upper and Lower—34' 1⅜"
Length—30' 1"
Height—10' 2"
Chord—4' 7½"
Gap—4' 8"
Angle of Incidence—Upper 1° 45', Lower 2° 15'
Dihedral—1° 15'
Wing Area—284.4 sq. ft.
Aerofoil Section—RAF—15

Gross Weight—2175
Maximum Speed—120
Engine—Wright E-3, 220 H.P.
Designed—by Chance Vought Corporation. (Mr. Chance Vought.)
Built by Chance Vought Corp.
Pilot: H. A. Elliot, Lieutenant, U.S.N.

Tractor Biplane

Span—Upper and Lower—22' 8"
Length—20' 9"
Height—8' 0"
Chord—4' 0"
Gap—4' 0"
Angle of Incidence—0
Dihedral—2° (Lower wing only)
Wing Area—168
Aerofoil Section—Sloane
Gross Weight—2095
Maximum Speed—186
Stalling Speed—65
Trial Report.—No. 115, dated March, 1922.
Engine—Curtiss D—12, 400 H.P.
Designed by Curtiss Aeroplane & Motor Corpn. (Messrs. Gilmor, Booth & Thurston).
Built by Curtiss Aeroplane & Motor Corp. Sept. 1921.
Pilot: F. Fechteler, Lieutenant, U.S.N or H. J. Brow, Lieutenant, U.S.N.

Tractor Monoplane

Span-28' 1"
Length-21' 1¼"
Height-6' 4 1/2"
Chord-2' at tips to 6' at fuselage
Gap-O
Angle of Incidence-O
Dihedral-3 1/1°
Wing Area-104
Aerofoil Section-Gottengen No. 387
Gross Weight-2020
Maximum speed-190
Stalling Speed-70
Engine-Wright H-3, 400 H. P.
Designed by Aerial Engineering Corp (Messrs. Booth & Thurston)
Built by Aerial Engineering Corp.
Pilot: S. W. Calloway, Lieut. (jg) U. S. N

Tractor Monoplane

Span-28' 1"
Length-21' 1 1/4"
Height-6' 4 1/2"
Chord -2' at tips to 6' at fuselage
Gap-O
Angle of Incidence-
Dihedral-3 1/2°
Wing Area-104
Aerofoil Section-Gottengen No. 387
Gross Weight-2020
Maximum Speed-190
Stalling Speed-70
Engine-Wright H-3, 400 H. P.
Designed-by Aerial Engineering Corp (Messrs. Booth & Thurston)
Built by Aerial Engineering Corp.
Pilot: David Rittenhouse, Lieut. U. S. N.

Tractor Biplane

Span-Upper and Lower-22' 8"
Length-20' 9"
Height-8' 0"
Chord-4' 0"
Gap-4' 0"
Angle of Incidence-0
Dihedral-2° (Lower wing only)
Wing Area-168
Aerofoil Section-Sloane
Gross Weight-2095
Maximum Speed-186
Stalling Speed-65
Trial Report, -No. 115, dated March, 1922.
Engine-Curtiss CD-12, 400 H. P.
Designed by Curtiss Aeroplane & Motor

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The National Airplane Races this year will be as important as the National Motor Car Races in the early days, because they will bring out the qualities and defects in the various flying machines. The main event will be the Pulitzer Trophy Race, a contest for the fastest land Machines, which will be held over a triangular course totalling 160 miles (4 laps of 40 miles each), the entire course being over the waters of Lake St. Clair, with the exception of the landing and finishing point at Selfridge Field, Mt. Clemens.

The Army pilots and alternates, and the machines they are to fly, are as follows:

Army Entries in Pulitzer Race

Events	Type	Pilot	Alternate
Event No. 2.	L. W. F. "Owl"	Lt. Ernest E. Harmon	Lt. Leslie P. Arnold
Large capacity multi-motored airplanes	Martin Bomber	Capt. W. R. Lawson	Lt. Raymond E. Davis
	" "	Lt. Chas. M. Cummings	Lt. Levi L. Beery
	" "	Lt. Gerald E. Ballard	Lt. Chas. B. Austin
	" "	Lt. Phillip Melville	Major John H. Pirie
	Martin Transport	Lt. Erik H. Nelson	
Event No. 3.	Fokker Transport	Lt. O. G. Kelly	Lt. R. S. Worthington
Light Commercial airplanes	DH4B	Lt. Harold R. Harris	Major Fred H. Coleman
Event No. 4.	DH4B	Lt. Benj. R. Morton	Lt. Frank M. Paul
Observation type, 2-passenger airplanes	"	Lt. James D. Givens	Capt. Ernest Clark
	"	Lt. Warren R. Carter	Lt. Edwin B. Robzien
	"	Maj. Follett Bradley	Major F. L. Martin
	LePere	Lt. T. K. Koenig	Lt. John W. Monahan
	"	Lt. Wm. L. Boyd	Lt. Geo. W. Goddard
	XBLA	Lt. Dale V. Gaffney	Lt. Delmar H. Dunton
	"	Capt. Lloyd L. Harvey	Lt. Howard K. Ramey
Event No. 4.	VCP-1-600HP	Lt. C. S. Moseley	Lt. L. Wade
High Speed Pulitzer	Curtiss CD12 375 hp	Lt. R. L. Maughan	Lt. Bushrod Hoppin
	" " " "	Lt. L. J. Matland	Lt. C. V. Haynes
	Loening, 600 h. p.	Lt. E. C. Whitehead	Lt. G. P. Tourtellot
	" " "	Lt. L. D. Schulze	Lt. J. T. Hutchison
	Thos. Morse, 600 hp	Capt. F. O. D. Hunter	Lt. C. E. Crumrine
	" " " "	Lt. C. L. Bissell	Lt. T. K. Matthews
	Sperry, 350 h. p.	Lt. E. H. Barksdale	Lt. G. C. McDonald
	" " "	Capt. St. C. Streett	Lt. V. S. Miner
	" " "	Lt. F. B. Johnson	Lt. K. N. Walker
	M. B. 3	Capt. Burt E. Skeel	Capt. Albert M. Guidera
	"	Lt. Benj. K. McBride	Lt. Walter H. Reid
	"	Lt. Donald F. Stace	Capt. Vincent B. Dixon
	"	Capt. H. M. Elmendorf	Lt. Roy P. Mosher
"	"	Capt. Oliver W. Broberg	Lt. Hobert R. Yeager
		Lt. James D. Summers	Lt. Roy W. Camblin

Detroit-Cleveland Flying Boat Line Carrying Many Passengers

With the starting of a double daily flying boat service between the two Lake cities by the Aeromarine Airways a new chapter in the development of commercial aviation in America has commenced.

Every day, promptly at 9 A.M., one of the Aeromarine eleven passenger enclosed-cabin flying limosines leaves the airport in Detroit for Cleveland, and in the latter city another flying boat of the same type takes the air bound for Detroit. The return flight is made from both cities at 5 P.M. The flying time in this division of the Aeromarine Airways is 90 minutes as compared to 5 hours on the train.

The fare is $75 round trip and $40 one way. C. F. Redden, president of the company, through whose efforts this airway was established, stated today that as the volume of passenger traffic grew so would the rate of fare be reduced.

So popular has this new mode of travel between Detroit and Cleveland become that reservations have to be made several days in advance if seats are desired. On Fridays and Saturdays it is almost impossible to secure seats unless ample advanced notice is given the company. Four huge flying boats are used on this service. They are the famous "Santa Maria," holder of the world's record for distance flown, the "Wolverine," the "Buckeye" and the "Niagara."

The equipment at both the Detroit and Cleveland terminals is complete in every way. A luxurious house boat, from which passengers are taken aboard the flying boats, a speedy and comfortable motor launch and automobile parking space at the landing docks make air travel via Aeromarine flying boats comfortable from the moment the ticket is collected at the terminal until the passenger arrives at his destination.

As the crow flies, the distance between cities is 112 miles and an elaborate and carefully planned method of communication has been established through signal stations, en route. When the morning boat leaves Detroit, at the main operating base, it flies down the Detroit River and lands at the foot of First Street in the heart of the downtown business section where additional passengers are taken aboard. Taking the air once more the flight is continued over the river until Lake Erie is reached. At the mouth of the Detroit River is a signal tower and the exact time the flying boat passes is immediately telephoned back to Detroit. There are other signal stations en route, at Put-In-Bay, Vermillion, O., and Lorain, O. and the same procedure is followed.

With this method the boats are undre constant observation and the exact time of their arrival can be announced at the dock a half hour before the flying boat arrives.

The schedule has been maintained without interruption since the service was started and in nearly every case the boats arrive on time. In the matter of departures also the strictest attention is paid to getting the boats away on time and already several tardy pasengers, arriving a few minutes late, have been forced to realize that when a departure time is set the boat departs promptly.

Each seat in the beautiful enclosed-cabins is numbered and every passenger knows beforehand just where he will sit. This avoids unnecessary delay and confusion and prevents misunderstanding among those making the flight.

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Landing Field Buildings

Types, Sizes and Cost of Buildings for Civil Aeroplane Landing Fields.

By Archibald Black, Consulting Engineer, Garden City, N.Y.

Size of Hangars

THE sizes and shapes of hangars to be used depend entirely upon the size of machines, the operating practice and the importance of the fire risk. Before the kind of buildings to be used is decided, each of these points should be carefully considered. Information on the dimensions of the machines, likely to be used at the field, should be obtained and tabulated before any other step is taken. Construction of hangars without first assembling this data may result in either great waste of space or in the provision of hangars in which some machines arriving at the field cannot be housed. Obvious though this should be, it is quite often neglected. Table 1 gives the housing dimensions of a wide range of machines, water and land types, including military, sport and commercial. These can probably be regarded as representative of the machines likely to land at a municipal or other field in the United States.

One of the next points to be considered is the question of whether individual hangars are to be used or whether several machines are to be housed in each hangar. The former method is preferable, but has the disadvantage of requiring greater investment in buildings. The latter is more economical in cost, but increases the possible loss in the event of fire. In addition, if the hangar is to be much longer than it is wide, it will be impossible to remove machines housed in the rear without moving those nearer the door. It is this consideration which makes the deep Army hangars unsuitable for civil purposes. Where hangars are to be leased to several different parties, the single machine type of hangar is particularly desirable on account of its keeping the property of each lessee separate.

If only one machine is to be housed in each hangar, and the maximum size is definitely known, a hangar can be selected which permits the housing of this machine with a minimum clearance for each side, front and rear of 2 to 5 feet, depending upon the size of the machine. The door should be of such size as to clear the highest part of the machine (with propeller swung out of the way), with tail either up or down, by not less than 12 inches. Where more than one machine is to be housed in one hangar, scale paper layouts of the machines to be housed should be made and several arrangements tried on paper until the most economical use of space is determined. Ample clearances should be allowed to permit moving of machines. It is advisable to consider only the use of standard sizes of hangars unless the project is an extremely large one requiring a complete chain of fields. Table 2 gives the dimensions of most of the standard hangars which can be obtained in this country.

Types of Hangars

Generally speaking, hangar construction may be divided into five classes. Arranged in the order of their usual cost these are: (1) tent; (2) canvas on rigid frame, usually of wood; (3) all wood; (4) all steel and (5) the factory type of brick, steel and glass with timber roofing. The tent hangar is simply a temporary housing, being a canvas tent shaped to house the aeroplane. It should not be considered for any other purpose than emergency housing. Its value even as a temporary hangar is to be questioned. The second type, canvas on wood frame, is also temporary and more or less of a makeshift at best. Contrary to a quite general impression, it is not practicable to erect this type and later replace the canvas with wood. The frame is very light and will not carry the additional weight of the wood siding and roof.

The all-wood hangar can be regarded as a permanent type of construction and has been used to quite some extent in this country. It was, in fact, the first type to be used. This type is, however, rapidly being supplanted in public favor by the all-steel type, which has the advantage of being a lesser fire hazard. This change is due to the standardization of the steel hangar having brought its cost down to the point where it is comparable with wood and sometimes lower. The factory type of building being the most expensive type of construction, the all-steel may be regarded as the most generally suitable for hangar purposes. Table 3 gives the approximate costs, per square foot of floor space, of the construction of the various types of hangar, shop and other buildings in the eastern part of the United States. These costs are compiled with great care and can be relied upon, subject to the usual fluctuation in building costs. A substantial reduction in outlay will be obtained if the aeroplanes are finished sufficiently to withstand exposure and are stored by being fastened down to the field with cockpits, engine, propeller, etc., covered with tarpaulins. The only hangars then required will be such as are necessary for shop purposes and to house machines on which work is being done. It should be remembered that aeroplanes should be specially well weather-proofed if this practice is to be used. Another method of reducing the building investment, but which is not always practicable, is to construct hangars shaped to fit the machine instead of being rectangular. This gives a building of T-shape in plan, and, while costing more per square foot of floor, the cost *per machine* is slightly reduced.

Types of Hangar Floors

Four types of floors for hangars have been in general use to date. These are: (1) dirt; (2) cinder; (3) wood and (4) concrete. The first is entirely unsuitable and is really no floor at all. The second, properly laid and rolled, is very economical and quite satisfactory for hangers not

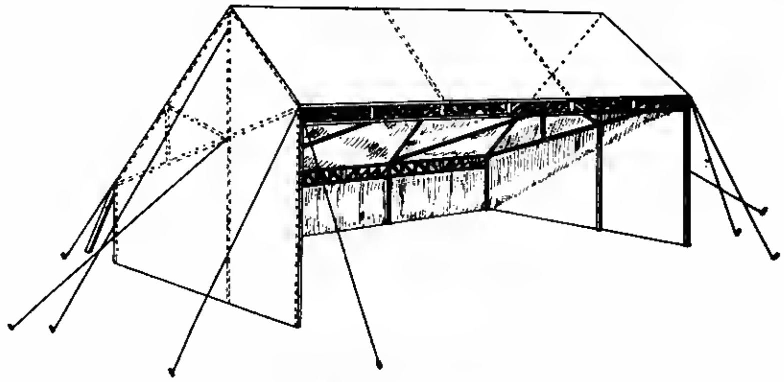

Fig. 1: Wood and Canvas Hangar Richards

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Fig 2: All Steel Hanger (Millken) with Curtain Doors

used much as shops. It also has the advantage of absorbing gasoline or oil while providing a firm footing. While it gradually hardens with use, the surface can be restored by applying and rolling a couple of inches of additional cylinders when necessary. The last two types of floor are each very satisfactory so far as performance is concerned, but are expensive and should not be considered for most *hangar* purposes on this account. They are, however, more suitable for shop floors than the cinder type. The cinder floor is constructed by spreading clean cinders over the surface of the earth inside of the building and rolling down until firm. The finished floor should be about 6 inches thick, which will require about 9 inches of loose cinders to be spread before rolling. The 6 inches of finished floor raises the level sufficiently above the surrounding soil to ensure dryness in most cases. It may sometimes be necessary to increase this depth if the surrounding soil holds much water. The increased height can be obtained economically by filling in and rolling several inches of soil before spreading the cinders. A finished floor elevation of, say, 12 inches thus obtained can be relied upon to keep the building dry even if the surroundings are damp. Table 4 gives the approximate costs of construction for different types of floors in the eastern part of the United States. Such costs are subject to considerable variation according to local labor conditions and cost of materials. However, the figures given are sufficiently accurate for all preliminary estimate purposes.

Hangar Doors

The most important single feature of the hangar construction is the door through which the aeroplanes are moved. Several types of hangar doors are shown in Figure 5. The horizontally hinged type have been found to operate well when new, but they do not stand up under rough and constant usage. As landing field equipment is exposed to high winds, as well as being usually neglected, these types should be regarded as unsuitable on account of their liability to damage. The curtain type of door is, by far, the most economical so far as initial cost is concerned. While it requires some care also, and must be securely tied at all times, it has the advantage of being easily repaired and stands up fairly well. Where funds are limited this type of door should be used, excepting in localities where very high winds are frequent. When such doors are installed a rule should be made of always fastening the curtain whether open or closed.

The folding type and the rolling type of doors are each very satisfactory, but fairly expensive. They require less maintenance than the curtain door and are therefore cheaper in the end. For all ordinary purposes these doors can be generally recommended. The bascule door, motor operated, is probably the very best type of hangar door used. It is, naturally, the most expensive. The rolling steel shutter type of door is also a very good door, but an expensive one. It is not so convenient to operate as the bascule type, even if power for operation were to be furnished. The limits in the practical widths of the steel rolling shutters necessitates there being several of these used to close the ordinary hangar opening. This, at the same time, requires the use of folding guides which have to be swung out of the way after the shutters are raised. Whether the additional expense of these latter types of doors is justified will depend upon the particular project.

Shops and Garages

No trustworthy general rules can be laid down for the area of shop and garage space which is required at any field for a given number of aeroplanes. The Army and Navy field conditions are so different from those found at civilian fields that any figures from such sources would only be misleading. In the case of fields where hangars are provided for all of the aeroplanes, the question of shop space may usually be considered to be taken care of in the hangars themselves. There will be sufficient clear space around the machines to provide room for work benches, etc., for the repair work. There will be some exceptions to this, however. In the case of organized airlines, repair work will probably be concentrated in one building on each field in the interest of efficiency. Also in cases where the practice of fastening aeroplanes down to the field, instead of housing them, is used, one shop building of the hangar type will be necessary. In the latter case, if this building is large enough to house the largest aeroplane at the field, it can be used both for small work and assembly purposes. With civilian fields of the present capacity, this one building will be found to be amply sufficient. In the case of organized airlines no general rules can be given; each case must be worked out in detail to suit conditions.

Fig. 3: Steel frame hangar with corrugated asbestos sides and roof, and with motor operated Bascule door (Streus)

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The garage space necessary is subject to similar variation. In this case the best policy is probably to set aside a convenient plot for the future garage and to erect no buildings for this purpose until actually required. When the need arises, a standardized steel building meeting immediate needs should be erected, leaving space for expansion at the side and in the rear. As expansion became necessary, additional sections could be added to the original building, the former side or rear end covering being moved to the new side or end of the structure.

Table 1—Housing dimensions of typical aeroplanes (to nearest inch)

Make and Model	Width Overall		Length	Height with Propeller Horizontal	Type
	Wings on	Folded or Wings off			
LAND MACHINES					
Air Service Messenger	20′ 0″	7′ 0″	17′ 9″	7′ 0″	Sport or messenger
Thomas-Morse MB-7	24′ 0″	8′ 0″	18′ 6″	7′ 3″	Scout
Curtiss Oriole	40′ 9″	10′ 11″	26′ 1″	10′ 3″	Sport
DH-4	42′ 6″	13′ 7″	29′ 11″	9′ 8″	Fighter
Curtiss JN-4	43′ 7″	9′ 9″	26′ 11″	9′ 10″	Training
Curtiss 1-Engine Eagle	64′ 4″	17′ 6″	37′ 3″	13′ 6″	Commercial-passenger
G. L. Martin MB-2	74′ 2″	37′ 10″	43′ 7″	15′ 7″	Bomber
WATER MACHINES					
Loening Model 23	43′ 0″	10′ 0″	33′ 0″	8′ 9″	Sport
Aeromarine Series 40 and 50	48′ 6″	11′ 0″	28′ 11″	12′ 7″	Sport
Curtiss Seagull	50′ 3″	11′ 11″	28′ 10″	11′ 9″	Sport
Curtiss HS-2, Aeromarine 80	74′ 0″	15′ 1″	38′ 6″	14′ 7″	Naval passenger
Navy F-5-L, Aeromarine 75	103′ 9″	19′ 6″	49′ 4″	18′ 9″	Naval passenger

NOTE: Add 12″ to 24″ to height of water types to allow for height of handling truck.

Wood flooring is much to be preferred for the shop buildings. For an assembly shop a cinder floor is quite usable, but not so satisfactory as the wood. For other shops the wood is the only really suitable floor. The planked wood floor can be considered as the most suitable for general shop purposes, while the wood block floor is most satisfactory for machine shops, engine overhaul and similar shops. For garage purposes the concrete type of flooring is the most suitable, but cinder floors are also satisfactory. The use of any type of wood floor for garage purposes is not advisable. All shops should be well lighted, both naturally and artificially. These buildings, or parts of buildings, should be heated in cold weather, otherwise the working efficiency of the staff may be expected to drop very greatly. Toilet facilities should be provided for each building if large and for each group of buildings if small. There should be modern equipment if running water is available, otherwise outhouses should be constructed in convenient locations. So far as the type of construction is concerned, shop buildings may be similar to the hangar buildings. Standardized steel buildings are particularly suitable for garage use. Dope rooms in shops should be separated, by partitions, from the rest of the building in which they are located. Such rooms should also be well ventilated directly to the outer air. If much doping is to be done, this ventilation should be obtained by the use of exhaust fans.

Space for Construction of Complete Aeroplanes

In the case of shops which are to be used for the construction of complete aeroplanes a little more information is available. This space will vary

Table 2—Dimensions of Standard Hangar and Shop Buildings

Type	Inside Width	Length	Height	Door Size	Sides	Frame	Sheeting	Remarks
Type H Bessonneau	66′ at cols. 76′ bet. cols.	79′	13′ at eaves 17′ at center	13′ high 66′ wide	Sloping	Wood	Canvas	
U. S. Air Service Wood and Canvas	66′ at cols. 73′ bet. cols.	98′	16′ at eaves 21′ at center	16′ high 66′ wide	Vertical	Wood	Canvas	
U. S. Air Service 66′ x 140′ Steel	66′	140′	14′ at eaves and center	14′ high 66′ wide	Vertical	All Steel	Galv. iron	Curtain type door
U. S. Air Service 110′ x 200′ steel	110′	200′	28′ at eaves and center	28′ high 110′ wide	Vertical	All Steel	Galv. iron	Curtain type door
Milliken, 11 ft.	20′, 40′ or 60′ 7′ addit. bet. cols. in slop. sides	Units of 20′ no limit	11′ at eaves and center	11′ high x multiples of 20′ wide	Sloping or vertical	All steel	Usually galv. iron	Any type door
Milliken, 14 ft.	20′, 40′ or 60′	Units of 20′ no limit	14′ at eaves and center	14′ high multiples of 20′ wide	Vertical	All steel	Usually galv. iron	Any type door
Milliken, 17 ft.	20′, 40′ or 60′	Units of 20′ no limit	17′ at eaves and center	17′ high multiples of 20′ wide	Vertical	All steel	Usually galv. iron	Any type door
Milliken, 21 ft.	20′, 40′ or 60′ 7′ addit. bet. cols. in slop. sides	Units of 20′ no limit	21′ at eaves and center	21′ high multiples of 20′ wide	Sloping or Vertical	All steel	Usually galv. iron	Any type door
Austin Modified No. 3 Standard Bldg.	About 48′	Multiples of 20′ no limit	13′ at eaves and center	13′ high about 48′ wide	Vertical	Steel truss and cols.	Wood roof, steel sash, brick walls	Any type door
Austin Semi-Standard	70′, 80′, 90′ and 100′	Multiples of 20′ no limit	Any	Width of Building any height	Vertical	Steel truss and cols.	Usually steel sash and brick walls	Any type door
Strauss Type "A"	100′	100′	18′	18′ high 100′ wide	Vertical	All steel	Corrugated galv. iron	Strauss hascule door operated by 5 h.p. motor
Truscon Steel Co. Type 1-S	32′, 40′, 48′, 50′ and 60′ less cols.	Multiples of 2′	8′-0″, 10′-8″, 13′-4″, 16′-0″, 18′-8″ and 21′-4″	Approx. same as bldg. height and width	Vertical	All steel	18 ga. flat copper steel	Small doors or open end only (for curtain door)
Belmont Iron Works	66′	Multiples of 20′	14′, 18′ and 28′	14′, 18′ & 28′ high 66′ wide	Vertical	All steel	Corr. steel or asb. prot. metal	Steel sliding door
Belmont Iron Works	110′	Multiples of 20′	28′	28′ high 110′ wide	Vertical	All steel	Corr. steel or asb. prot. metal	Steel sliding door
Belmont Iron Works	66′	Multiples of 20′	40′	40′ high 66′ wide	Vertical	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door
Belmont Iron Works	45′	Multiples of 20′	46′	46′ high 45′ wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door
Belmont Iron Works	70′	Multiples of 20′	75′	75′ high 70′ wide	Sloping	All steel	Corr. steel or asb. prot. metal	Balloon hangar Steel sliding door

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Table 3—Landing field buildings. Approximate cost in the eastern part of the United States, June, 1922

Uses of Building	Type of Construction	Approx. Size	Cost per Sq. Ft. Erected		
Factory, hangar, shop or garage.	Factory type. Steel frame, brick and glass sides. Wood roof. Erected complete on concrete foundations. Without floors. Clear span, 60′ to 100′.	60′ x 100′ and up. 12-14′ high.		$1.25 1.50	$1.50 1.
			in Greater New York		
Hangar, shop or garage.	All steel. Standardized, galv. sides and roof, with trim and ready painted. Erected on concrete piers. No floor. Clear span to 60′.	60′ x 100′ or less. 14′ high.	Bldg., Erect.,	$0 60 .25	$0.75 .30
				$0.85	$1.05
Shop, garage, stockroom, radio, etc.	Light weight, all-steel, galv., unpainted. Erected on posts. No floor.	About 20′ x 25′. 8′ high.	Bldg., Erect.,	$0.90 .20	$1.05 .30
				$1.10	$1.35
Hangar, shop, garage, etc.	Large frame buildings. Wood truss, clear span to 50′. Wood siding and roof. Roof tar paper covered. Erected on posts. No floor.	Span up to 50′. Any length. 12′ high.	Mater., Erec. & paintg.	$0.40 .40	$0.50 .60
				$0.80	$1.20
Office, stockroom, radio, etc.	Small wood frame buildings. Sectional type, bolt-together. Complete with all trim, partitions and ready painted. ⅞″ flooring.	12′x18′ to 18′x36′ 8′ headroom.	Bldg., Erect.,	$0.65 .15	$1.40 .25
				$0.80	$1.65

NOTE: These costs based upon construction of more than one building. Slightly higher for single buildings. Subject to increase in case of poor transportation or other such conditions. Heating, water, lighting, etc., *not* included. Hangar prices include only the less expensive types of doors.

Based upon numerous estimates furnished for the purpose.

Table 4—Building flooring, heating and lighting. Approximate cost of installation in the eastern United States, June, 1922

FLOORING COSTS		Cost per Sq. Ft. in place	
CONCRETE.	4″ floor, plus 1″ finish; total, 5″	$0.18	$0.25
CINDER.	9″ steam cinders, spread and rolled manually to 6″. Cost varies greatly according to local cost of material. Probable range	.05	.10
WOOD.	9″ cinders, rolled to 6″; 3″ x 4″ creosoted sleepers; 1″ Y. P. rough sub-flooring, creosoted on under side; 1″ maple finished floor. Total cost	.33	.38
	Same floor on concrete base (4″ rough concrete)	.40	.45
WOOD BLOCK.	4″ rough concrete base. Wood blocks on edge. Total cost	.40	.45

For preliminary estimate purposes assume flooring unit cost to vary inversely with the size of building as well as with local conditions.

LIGHTING AND HEATING	Cost per Sq. Ft. of Floor Area for equipt. installed	
General shop lighting without drop lights or any special outlets, etc. Inside work only, no feeders. (Electrical)	$0.03	$0.07
Shop heating plant completely installed. Steam system. To maintain ordinary shop working temperature	.25	.40

Lighting and heating cost subject to great variation and should be considered as crude approximations. For preliminary estimate purposes the use of the higher figures is advisable.

not only with the output but also with the plant efficiency, size of machine and its type. In general, seaplanes will require more floor space than land machines and flying boats will require more space than seaplanes for their construction and for the same output. During the war a number of large aeroplane factories turned out these machines in large quantities, using the following space: Total floor space per complete machine per day in quantity production ranging from 25,000 sq. ft. for small training machines to 60,000 sq. ft. for larger single engined machines. The area required is actually quite elastic and greatly affected by the conditions mentioned above. It is reasonably safe, however, to assume for preliminary purposes that 15,000 to 20,000 sq. ft. of floor will be required in the shop for an output of one complete moderate-sized (say 3,000 pounds fully loaded) aeroplane per week if the plant is to be run at full capacity. This space should be increased with the size of the machine and should be liberally increased if more than one type of machine is to be built at the same time.

Several more or less efficiently arranged American factories show about the following average division of their floor space for construction of different types of machines. It should be safe to use these figures in the original layout of the shop, modifying the division later if it becomes necessary:

	Per cent of total shop space
Stockroom	8
Wood shop	16
Metal shop	22
Wing, etc., building	12
Assembly room	20
Dope and paint shop	8
Shipping and finished storage	8
Offices	6

Field Office and Stockroom

No matter how small the field equipment may be, some suitable heated and lighted space should be provided for office and stockroom. In the case of very small fields a 20 x 20 foot building is ample for both purposes. If some type of standardized steel or sectional wood building is used it can be extended from time to time as the field equipment expands. Many of the buildings of these types now on the market are suitable for the purpose. It will usually be found cheaper, as well as more convenient, to purchase such instead of having the local contractor erect special buildings which do not provide for the future expansion. Sectional wood buildings measuring about 18 x 24 feet, and reassembled in the field by bolting all toether. Figure 6 shows the appearance of a completed building of this type. This size of building can be erected complete by two men in about 2 to 3 days. The heating can be most conveniently obtained by the use of a small round stove. On a field where little repair or construction is done this will be all of the heating absolutely necessary. The partitions purchased with the building can be used to divide it into field office, locker room and stockroom. Where runnin water is available, a toilet can also be installed.

When our firm (A. & D. R. Black of New York and Washington) was in operation we designed a special

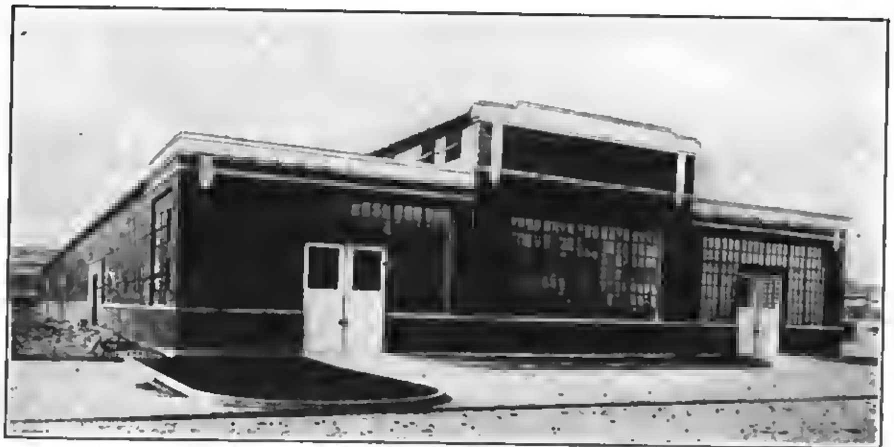

Fig. 4: Steel, Glass and Brick Type Building (Austin) Adapted to either Factory or Hangar use

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sectional wood building for field office use which is shown in Figure 7. This building is so elastic that it became referred to in our office as the "rubber building." The arrangement is shown very completely in the illustration and little comment is necessary. The construction is started with one 20 x 20-foot unit. Additional 20 x 20-foot units are added as the need arises. The former outer wall of the first unit becomes a partition between it and the new unit as the addition is made. Once erected, no part of the building is ever moved even when extending it.

Gasoline and Oil Houses

At any field where several different owners are likely to have machines at one time, or where any quantity of such supplies is kept on hand, some provision for storage of gasoline and oil is necessary. One of the smallest steel or sectional wood buildings may be used for this purpose. It will be found, however, that even the smallest sizes of these provide much more space than is necessary. If such buildings are used, liberal vents should be cut in the walls to avoid danger of accumulation of gas. Racks should be constructed for the oil barrels and, if gasoline is purchased in this way, for the gasoline barrels also. Shelving for grease and other supplies should be installed. If the gasoline is to be stored in an underground tank, the most satisfactory, economical and safest method, the pump should be located inside of this building with the hose connection extending outside. This method renders the gasoline inaccessible when the storage house is locked and prevents pilfering. Figure 8 shows a gasoline, oil and grease house, specially designed for the purpose by us. The drawings for this house were completely detailed and ready for use by any local contractor or the field force. While quite small, 8 x 8 feet, this house has sufficient capacity for what would be today considered a large field equipment. It was assumed that reserve oil barrels would be kept outside unopened in the event of a large supply being kept on hand. Oil and gasoline houses can, very often, be built by the field force out of lumber from wing crates.

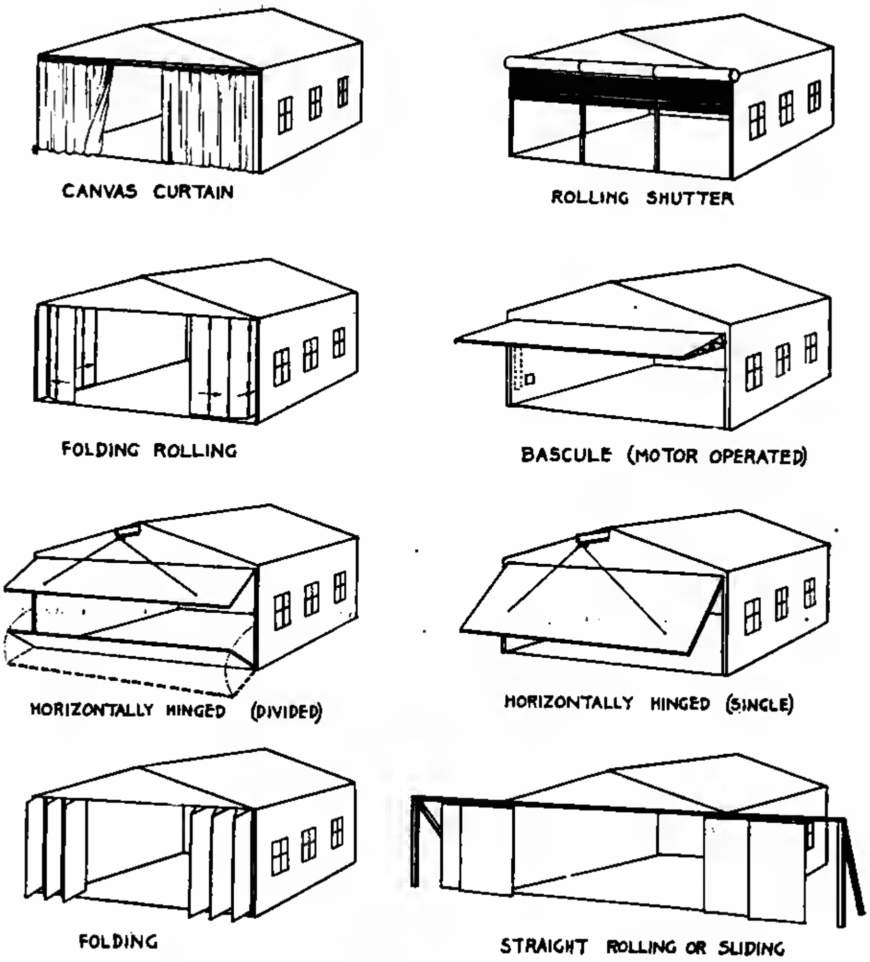

FIG. 5— TYPES OF HANGAR DOORS.

Miscellaneous Buildings

For special purposes such as barracks, remote controlled radio stations, dead storage, lunch rooms, etc., one or other of the standard steel or sectional wood buildings on the market will usually be found suitable. For gate-houses, either one of the small sectional buildings may be used or the local contractor or field men could build a one-man box for the shelter of the gateman. It is unlikely, however, that there will be any gateman to worry about at most of the fields to be considered in the near future. In cases where toilet facilities are not installed in the field office building, shops or hangars, one or more latrines should be located on the property. Knocked-down buildings, designed for this purpose, can be purchased for about $45, which is probably less than it would cost to have them built by a local contractor. It is also likely that wing crate lumber, available at the field, may be used considerably for the construction of these miscellaneous special buildings.

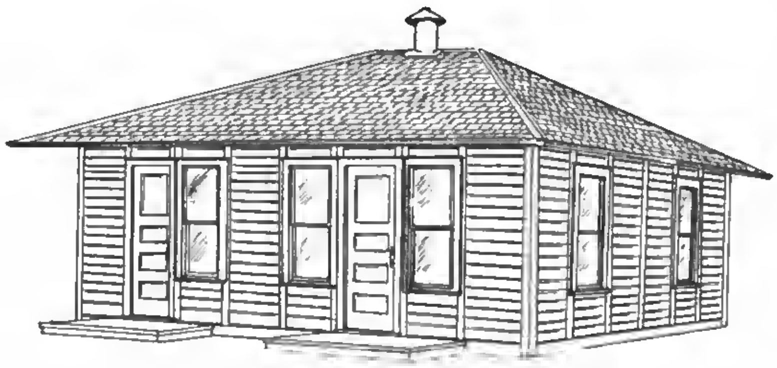

Fig. 6: Sectional Wood Buildings (Sears Roebuck & Co.)

Planning for the Future

In the selection of buildings for landing fields, as well as in the general arrangement of these fields, every

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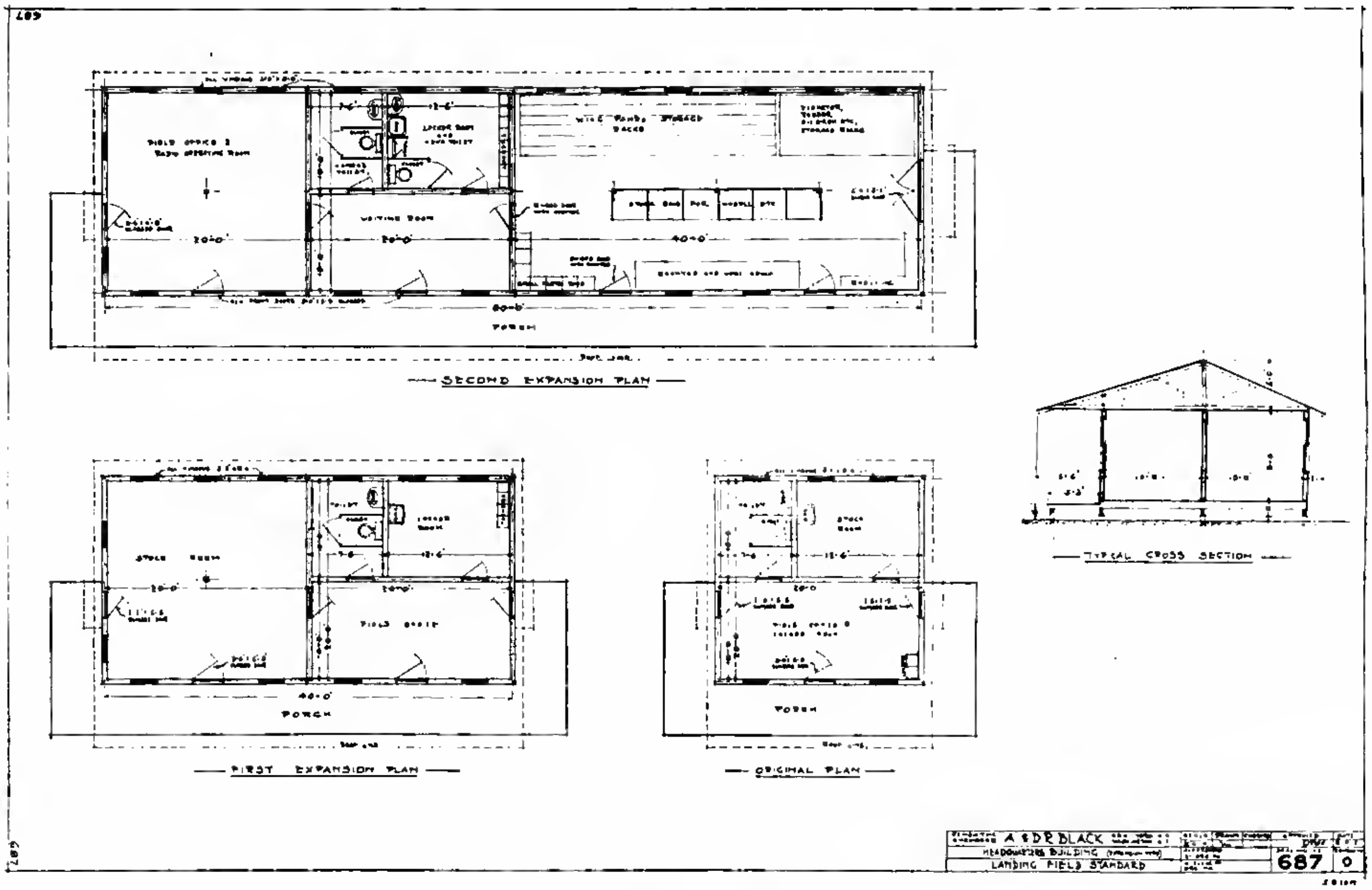

Fig. 7—Expansion Type of Field Building

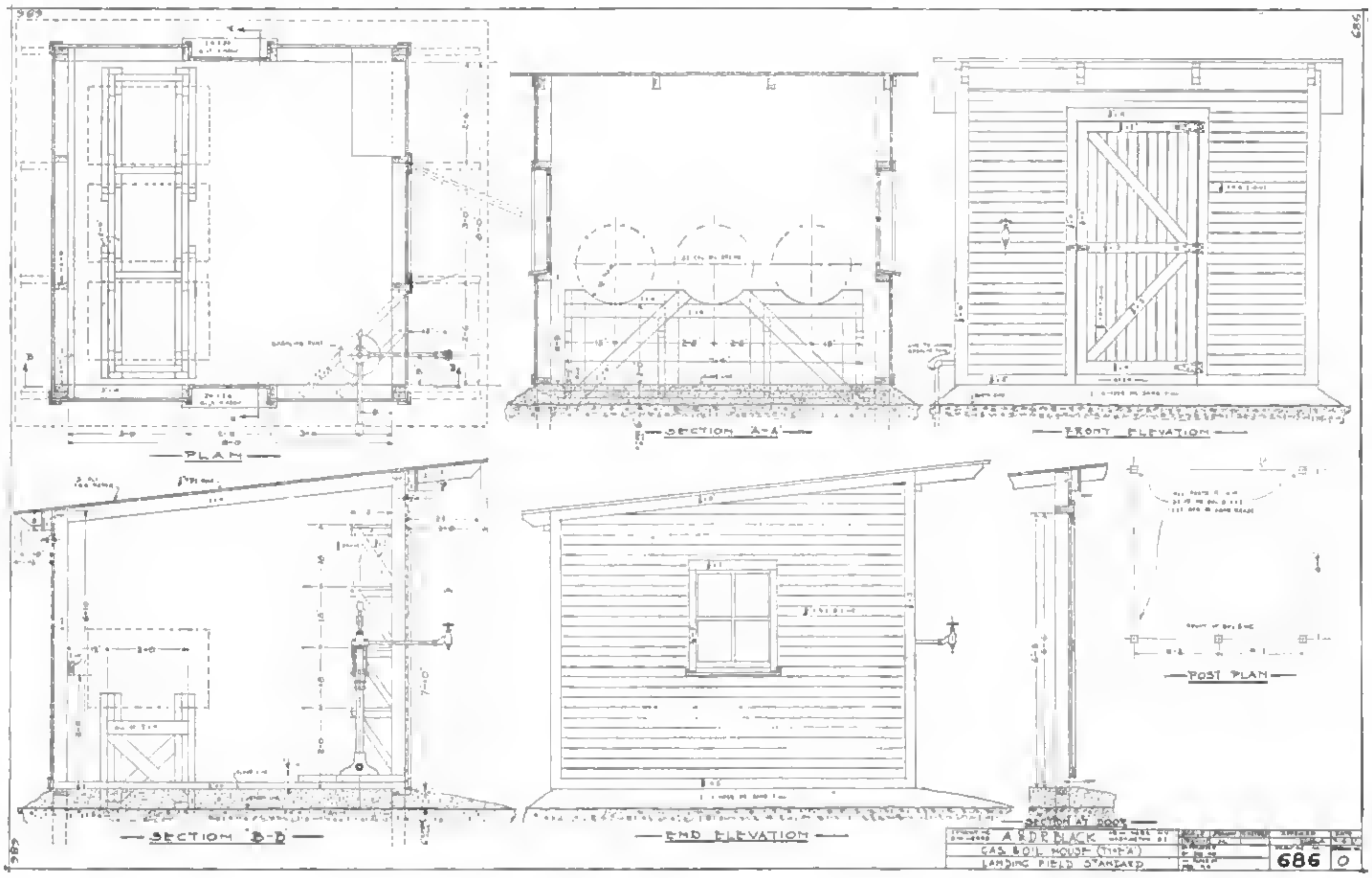

Fig. 8—Gasoline and Oil House

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The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sc., Curtiss Aeroplane and Motor Corporation

Introduction

THE determination of the performance of the engine-propeller combination is closely connected with the problem of predicting the performance characteristics of a given propeller. If tests on the model of the propeller are available, one needs only to combine its characteristics with those of the engine. When no model test can be made, the propeller characteristics must be predicted analytically. The latter problem is principally one of finding the secondary angles of attack of the propeller when the blade angles and section aerodynamic characteristics have already been found.

A propeller is said to operate under *primary* conditions when the angles of attack of the blade sections correspond to those chosen for the design conditions. When the angles of attack are altered due to a different combination of forward speed and revolutions than that for which the blade angles were determined, the propeller is said to operate under *secondary* conditions.[1]

[1] Refer to "The Design of Screw Propellers for Aircraft," H. C. Watts.

If we ignore the effect of compressibility, the thrust and torque of an airscrew are functions of

Velocity of translation, V
Revolutions in unit time, n
Diameter, D
Absolute density of air, $\rho = \dfrac{\delta}{g}$

where δ is the specific weight of the air, ρ the absolute density, and g the gravitational acceleration.

By dimensional theory it is proved that

$$\text{(Thrust)} \quad T = \rho n^2 D^4 f\left(\frac{V}{nD}\right) \qquad (1)$$

$$\text{(Torque)} \quad Q = \rho n^2 D^5 F\left(\frac{V}{nD}\right) \qquad (2)$$

The efficiency, η, is obviously a function only of $\left(\dfrac{V}{nD}\right)$; that is

$$\eta = \phi\left(\frac{V}{nD}\right) \qquad (3)$$

The functions f and F are usually termed respectively the thrust and torque coefficients. They are defined by

$$T_c = \frac{T}{\rho n^2 D^4} \qquad (4)$$

$$Q_c = \frac{Q}{\rho n^2 D^5} \qquad (5)$$

Dr. Leonard Bairstow has found that over the usual working range of an airscrew the following formulas hold very approximately true:

$$T_c = a - bJ^2 \qquad (6)$$
$$Q_c = c - dJ^2 \qquad (7)$$

where a, b, c and d are constants for a particular airscrew, and in which we use the abbreviation $J = \left(\dfrac{V}{nD}\right)$. The test for the validity of (6) is to plot T_c against J^2 to see how closely the curve follows a linear law; and for (7) to plot Q_c against J^2.

In Table I we give the characteristics and computed values for a two-blade propeller of typical form: Durand No. 116 (Report No. 64, National Advisory Committee for Aeronautics). The values of T_c and Q_c are expressed by Durand in the forms

$$T_c = \frac{T}{\delta V^2 D^2} \text{ and } Q_c = \frac{Q}{\delta V^2 D^3}$$

and we have transformed these coefficients into the forms of (6) and (7) by multiplying by 9.8 J^2, as the coefficients used in the above-mentioned report are expressed in terms of metric, gravitational units. The curves are given in Fig. 1.

We also give in Table II and Fig. 2 the data and curves for a model of the four-blade propeller for the B.E. 2_e, the characteristics of which are taken from Reports and Memoranda No. 344 of the Advisory Committee for Aeronautics (Great Britain.) In this case the curves show that Bairstow's equations are valid for an airscrew operating in the presence of the machine.

It is now evident that by estimating the thrust and torque of a propeller for primary conditions and, also, for some arbitrary value of J within the working range[2]

[2] The working range for J seldom exceeds 0.45.

we can at once determine the unknown constants a, b, c and d from the resulting four simultaneous equations. If the primary and secondary conditions, respectively, be designated by subscripts 1 and 2, we find:

$$a = \frac{T_{c_1}J^2_2 - T_{c_2}J^2_1}{J^2_2 - J^2_1}$$

$$b = \frac{T_{c_1} - T_{c_2}}{J^2_2 - J^2_1}$$

$$c = \frac{Q_{c_1}J^2_2 - Q_{c_2}J^2_1}{J^2_2 - J^2_1} \qquad (8)$$

$$d = \frac{Q_{c_1} - Q_{c_2}}{J^2_2 - J^2_1}$$

Then, knowing a, b, c, and d, we can plot the thrust and torque coefficients versus J. The efficiency is found as follows:

(Brake Power) $P_m = 2\pi nQ = 2\pi\rho Q_c n^3 D^5$
(Thrust Power) $P_t = TV = \rho T_c V n^2 D^4$
Hence

$$\text{(Efficiency)} \quad \eta = \frac{T_c}{2\pi Q_c} J \qquad (9)$$

which is also plotted against J.

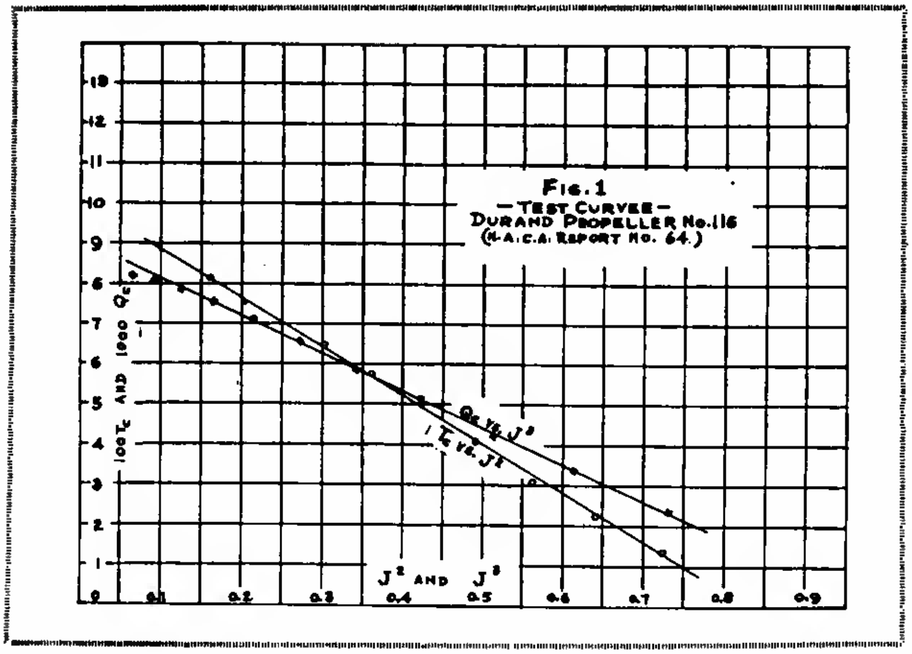

Fig. 1
—Test Curves—
Durand Propeller No. 116
(N.A.C.A. Report No. 64.)

Résumé of Propeller Theory

In the case of the airscrew having forward motion, it is convenient to consider the velocity in the slip stream relative to that of the undisturbed air. Fundamentally the increase of velocity as one moves down stream is due to the difference of pressure fore and aft of the disc caused by the circulation around the blades. Once in motion, the air (possessing considerable inertia) tends to remain in motion; and there results a general superposed inflow which must be taken into account when determining the velocity of the air relative to the blades.

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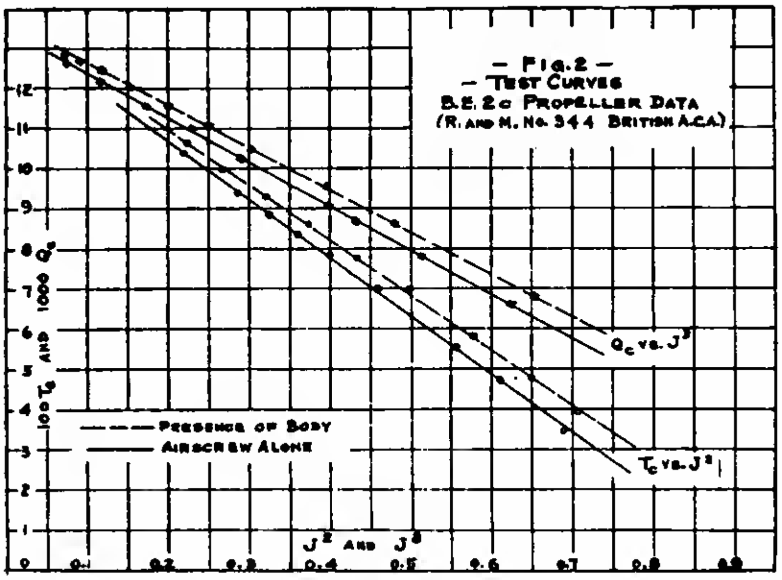


In examining the flow at a point in the stream, it is well to note that the total induced velocity at that point is due to the action of all the elements of the N blades of the propeller. For example, the flow at a point a given radial distance from the axis is not due simply to the action of a single blade element, at the same radius; but it is actually due to the action of all the elements on all blades. In the vortex theory one considers this velocity as being induced by the whole vortex system.

Let U be the general stream velocity of a mass of air passing through a small portion of an annulus of the disc. Apply the equation of d'Alembert for the accelerating force,

$$dF = dM \frac{d^2x}{dt^2}$$

Write $U \frac{dU}{dx}$ for $\frac{d^2x}{dt^2}$ and we have

$$dF = dM \cdot U \cdot \frac{dU}{dx}$$

Separating variables,

$$dF \cdot dx = U \cdot dM \cdot dU$$

We integrate between the limits of maximum and minimum velocity in the slip stream; thus:

$$\int\int dF\ dx = \tfrac{1}{2}\ dM\ (U^2_{max} - U^2_{min})$$

But $\int\int dF\ dx$ is the work done in unit time, and is equal to the product of the air reaction in the disc and velocity in the disc:

$$\int\int dF\ dx = dM\ U_d\ (U_{max} - U_{min})$$

when U_d is the velocity in the disc. Then we have the resulting relation

$$U_d\ (U_{max} - U_{min}) = \tfrac{1}{2}\ (U^2_{max} - U^2_{min})$$

Whereupon cancelling out the factor $(U_{max} - U_{min})$ we obtain

$$\frac{U_d}{(U_{max} + U_{min})} = \tfrac{1}{2}$$

Now U_{min} is equal to the velocity of the undisturbed air. Then if

$$U_d = U_{min} + k'U_{min}$$

and

$$U_{max} = U_{min} + k''U_{min}$$

we immediately find that

$$k'/k'' = \tfrac{1}{2}$$

Which means that half the added velocity is reached at the disc.[3]

[3]Refer to "The General Theory of Blade Screws," by George de Bothezat, N.A.C.A. Report No. 29, for a more complete proof of this last relation.

If we neglect the small radial component of the added velocity, we can consider the total acceleration of the fluid as being composed of two components perpendicular and parallel to the propeller disc. These we term the *axial* and *rotational* components of the *slip*. Let the proportion of axial slip to velocity of advance be designated by a and the ratio of rotational slip to peripheral speed be designated by b; then the resultant velocity of the air relative to the blade is given in magnitude and direction by

$$V_r = \sqrt{(2\pi rn)^2(1 - b/2)^2 + V^2(1 + a/2)^2} \qquad (10)$$

$$\tan\phi' = \frac{V(1 + a/2)}{2\pi rn(1 - b/2)} = \frac{1 + a/2}{1 - b/2}\tan\phi \qquad (11)$$

where, as shown in Fig. 3, the resultant velocity is denoted by V_r, and the effective pitch angle defined by

$$\phi = \arctan \frac{V}{2\pi rn}, \qquad (12)$$

r being the radius on the blade.

The differentials of thrust and torque are obtained by resolving the elemental total reaction at any radius into components perpendicular and parallel to the airscrew disc:

$$dT = dR \cos\ (\phi' + \gamma)$$

$$\frac{dQ}{r} = dR \sin\ (\phi' + \gamma)$$

where γ is the angle between the resultant reaction dR and the normal to V_r; that is, if we separate the total reaction into components perpendicular and parallel to V_r; then, as shown in Fig. 3,

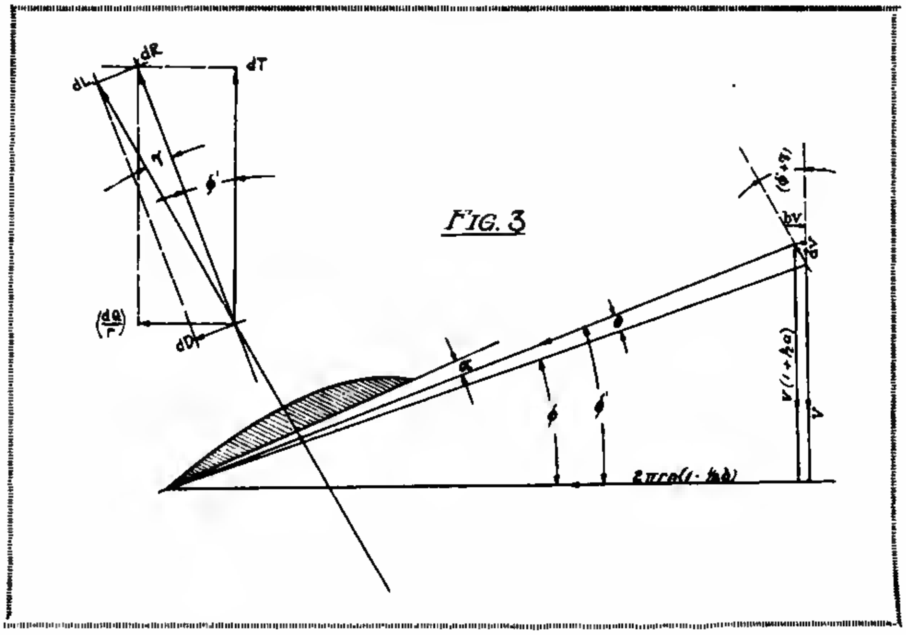
$$\frac{dR_D}{dR_L} = \tan\gamma$$

The flow around a propeller blade is quite similar to that around an aerofoil wing. The thrust is developed due to circulation. Vortices peel off the tips of the blades and dispose themselves over the slipstream boundary. We will therefore assume that the components dR_L and dR_D may be determined by expressions of the forms

$$dR_L = \rho\, C_L\ (c\ dr)\ V^2_r$$

$$dR_D = \rho\, C_D\ (c\ dr)\ V^2_r$$

where C_L and C_D are, respectively, the lift and drag coefficients of the particular blade element of chord c and area (c dr). The differentials of thrust and torque may then



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be written down in the following forms: we have per element per blade,

$$dT = \rho C_L \sec\gamma\, c(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \cos(\phi' + \gamma)\, dr \qquad (13a)$$

$$dT = \rho C_L c\,(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \cos\phi' (1 - \tan\phi' \tan\gamma)\, dr \qquad (13b)$$

$$dQ = \rho C_L \sec\gamma\, c(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \sin(\phi' + \gamma)\, r\, dr \qquad (14a)$$

$$dQ = \rho C_L c(1 + \tfrac{1}{2}a)^2 V^2 \csc^2\phi' \sin\phi' (1 + \cot\phi' \tan\gamma)\, r\, dr \qquad (14b)$$

It is, of course, necessary to evaluate either dT or dQ by only one of the above formulas, as we can make use of the obvious relation

$$\frac{dQ}{r} = dT \tan(\phi' + \gamma) \qquad (15)$$

The thrust of the blade elements at a given radius may be equated to the thrust produced by the change of momentum of the air passing through the annulus of the disc. This momentum thrust per blade is equal to

$$dT = \frac{2\pi r}{N}(1 + \tfrac{1}{2}a)aV^2 dr \qquad (16)$$

where N is the number of blades.

One must exercise care in writing down the relationship between the torque of the blade elements and the rate of change of angular momentum of the fluid, as the frictional forces are so large that they cannot be ignored. For our purposes we will not be required to seek the relation.

Let us assume that the fluid reaction in the disc is opposite and parallel to that of the blade element. It does not immediately follow that the total average slip,

$$\sqrt{(aV)^2 + (2\pi rnb)^2},$$

is opposite and parallel to dR; but it can be shown that, for high speeds of forward motion, when the contraction of the slip-stream is small, we can write with sufficient approximation,

$$\tan(\phi' + \gamma) = \frac{2\pi rnb}{aV} = \frac{b \cot\phi}{a} \qquad (17)$$

We now proceed to evaluate ϕ', which is also defined by

$$\phi' = \phi + \theta \qquad (18)$$

θ being the "slip angle." First equate (13b) and 16). We will obtain the equation

$$\frac{Nc}{2\pi r} C_L = \frac{a \tan\phi' \sin\phi'}{(1 + \tfrac{1}{2}a)(1 + \tan\phi' \tan\gamma)} \qquad (19)$$

Let the ratio of total blade width to circumference, at any radius, be designated by m; that is

$$\frac{Nc}{2\pi r} = m \qquad (20)$$

Then we obtain

$$\frac{a}{(1 + \tfrac{1}{2}a)} = \frac{m C_L (1 + \tan\phi' \tan\gamma)}{\tan\phi' \sin\phi'} \qquad (21)$$

The quantity a can be evaluated by means of (11), (12), and (17); from which we find that

$$a = \frac{2\cot\phi' (\tan\phi' - \tan\phi)}{1 + \tan\phi' \tan(\phi' + \gamma)} \qquad (22)$$

TABLE I.

DURAND PROPELLER NO. 116

Report No. 64 National Advisory Committee for Aeronautics.

J	J^2	J^3	T'_c	Q'_c	T_c	Q_c
.40	.1600	.064	.0518	.00522	.0815	.00820
.45	.2025	.091	.0380	.00405	.0756	.00804
.50	.2500	.125	.0285	.00321	.0700	.00787
.55	.3025	.166	.0219	.00255	.0650	.00756
.ω	.3600	.216	.0164	.00202	.0579	.00713
.65	.4225	.274	.0120	.00157	.0498	.00650
.70	.4900	.343	.0084	.00124	.0404	.00595
.75	.5625	.422	.0056	.00094	.0310	.00518
.80	.6400	.512	.0036	.00068	.0227	.00426
.85	.7225	.614	.0019	.00047	.0135	.00336
.90	.8100	.729	.0008	V .00030	.0065	.00238

NOTE: $T_c = 9.8T'_c\,(nD —)^2 = 9.8T'_c J^2$

TABLE II

PROPELLER FOR THE B. E. 2c.

Reports and memoranda No. 344, Advisory Committee for Acronautics.

Data for Airscrew Alone.

J	T_c	J^2	J	Q_c	J^3
.469	.1041	.220	.423	.01262	.075
.535	.0941	.286	.489	.01219	.117
.570	.0885	.325	.558	.01157	.173
.600	.0836	.360	.611	.01100	.228
.632	.0784	.399	.662	.01027	.290
.677	.0702	.458	.735	.00909	.397
.685	.0687	.469	.756	.00870	.432
.747	.0555	.558	.800	.00781	.512
.770	.0500	.594	.854	.00661	.623
.781	.0475	.610			
.829	.0349	.687			

Data for Airscrew in Preseice of Model.

J	T_c	J^2	J	Q_c	J^3
.475	.1064	.225	.416	.01280	.072
.518	.0998	.268	.442	.01268	.086
.565	.0930	.319	.494	.01236	.120
.611	.0861	.373	.534	.01203	.152
.661	.0778	.436	.585	.01158	.200
.705	.0699	.497	.630	.01107	.250
.760	.0586	.577	.672	.01051	.303
.805	.0479	.648	.734	.00954	.395
.840	.0395	.705	.783	.00862	.480
			.880	.00652	.681

We then obtain

$$\frac{a}{1 + \tfrac{1}{2}a} = \frac{2\cot\phi' (\tan\phi' - \tan\phi)}{1 + \tan\phi \tan(\phi' + \gamma)} \qquad (23)$$

Since, in determining the thrust and torque we make use of the quantity $V(1 + \tfrac{1}{2}a)$, we note from (12) that

$$V(1 + \tfrac{1}{2}a) = 2\pi rn \tan\phi' \frac{[1 + \tan\phi \tan(\phi' + \gamma)]}{[1 + \tan\phi' \tan(\phi' + \gamma)]} \qquad (24)$$

which formula gives the axial velocity of the air relative to the blade element.

After equating (21) and (23) we finally obtain the equation

$$\frac{mC_L}{2} = \frac{\sin\phi' \tan(\phi' - \phi)}{1 - \tan\gamma \tan(\phi - \phi)}$$

Or, since $\phi' - \phi = \theta$,

$$\frac{mC_L}{2} = \frac{\sin(\phi + \theta)\tan\theta}{1 - \tan\theta \tan\gamma}$$

Since θ and γ are both small angles (neither exceeding 6° or 8° over the working range, and usually having values less than 5°) we can safely neglect the term $\tan\theta \tan\gamma$ and write approximately,

$$\frac{mC_L}{2} = \sin(\phi + \theta)\tan\theta \qquad (25)$$

Aerodynamical laboratory experiments have shown that over a range of angles of attack, α, measured from zero lift of the aerofoil, to within about 4° of maximum lift, we can write very approximately

$$C_L = k\alpha$$

where k is the constant slope of the lift curve when plotted against angle of attack. If the total blade angle referred to the zero lift line of the section be designated by β_0, then the angle of attack of the section, measured with reference to the zero lift line is

$$\alpha = \beta_0 - \phi - \theta)$$

We can therefore write (25) as

$$(\beta_0 - \phi - \theta) \text{ —— } = \sin(\phi + \theta)\tan\theta \qquad (26)$$

Under the primary conditions for which the airscrew is designed, the angles of attack are usually arbitrarily fixed, and the slip angles and blade angles are unknown. The blade angles (except for the adjustable pitch propeller) remain fixed throughout the working range and hence the slip angles and angles of attack are to be determined for secondary conditions.

To solve (25), we recall that θ is a small angle and use the approximations

$$\sin\theta = \tan\theta = \theta$$
$$\cos\theta = 1$$

Then an ordinary quadratic in θ is obtained,

$$\theta^2 + \theta \tan\phi - \frac{mC_L}{2\cos\phi} = 0$$

Expressing θ in degrees, we find

$$\theta = 28.65 \tan\theta \left[\sqrt{1 + \frac{2mC_L}{\cos\phi \tan^2\phi}} - 1\right] \qquad (27)$$

Which formula is used for evaluating the slip angle for primary conditions, since C_L, m, and ϕ are all known.

In order to determine the secondary values of θ we proceed exactly as before, using (26). We find that, if k is taken in absolute units per degree, the quadratic obtained is

$$\theta + 57.3\mu\theta - 57.3^2 \left[\frac{mk(\beta_0 - \phi)}{2\cos\phi}\right] = 0$$

where we use the notation

$$\mu = \tan\phi + 28.65\frac{mk}{\cos\phi} \qquad (28)$$

The solution is

$$\theta = 28.65\mu \left[\sqrt{1 + \frac{2mk(\beta_0 - \phi)}{\mu^2 \cos\phi}} - 1\right] \qquad (29)$$

(To be continued)

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The Curtiss Sail Plane

Introducing a New Sport to America

FOR two periods of thirty seconds each, on Sept. 6, Glenn H. Curtiss remained aloft in his new sailplane of silk, wood and duralumin which he believes will eventually rise without motive power from the surface of the sea.

The tests were preliminary and purely experimental. There was no intention nor effort to establish a record and the results consequently appear all the more significant. Mr. Curtiss expressed himself as highly gratified with the manner in which the craft handled and declared that continued trials, day by day, would be made.

The demonstration was off Plum Beach, Port Washington, Long Island. There were present but a few people, officials of the Curtiss Aeroplane and Motor Corporation, the Aeronautical Chamber of Commerce and the Aero Club of America, and representatives of the press. There was practically no wind, shortly after 10 o'clock in the morning, when the sailplane was towed to the scene from the hangars of Lieut.-Comm. David McCulloch, in Port Washington Harbor.

The event was of extraordinary interest. Coupled with the international attention which is being given to gliding and sailing, was the fact that this marked the return of Mr. Curtiss to practical, actual flight. For five years of so Mr. Curtiss had not piloted a plane. His conviction that the flying boat could be adapted to sailing, thereby lessening the horse-power and decreasing the cost of operation, led to continued experiments in the Curtiss research laboratory at Garden City, under his personal supervision. The seaplane, being his own development, it was natural that he should reserve to himself the privilege to fly it first.

With Mr. Curtiss on Plum Beach was W. L. Gilmore, chief engineer of the Curtiss Aeroplane and Motor Corporation. Mr. Gilmore in a bathing suit, acted as assistant in the rather delicate undertaking of getting the sailplane towed properly and into the air. The towing was done by a speed boat, equipped with one of the Curtiss O X engines. Due to the excessive calm, difficulty was experienced with the towing cord, which snapped several times. But on the third towing trial, at a height of 20 or 30 feet, Mr. Curtiss cast loose, and, in spite of the dead air, sailed for half a minute. The ease of control was evident. The craft was equipped with the shoulder system of control, which Mr. Curtiss utilized in the early days of flying.

After a number of trials it became apparent that further effort at that point would be futile and preparations were made for the return. It was on this trip that the surprising developments came. It is about two miles from Plum Point to the McCulloh hangar. It took the speed boat about five minutes to make the trip. A cross breeze of slight velocity arose and for half the distance, Mr. Gilmore, sitting in the speed boat, literally "held" Mr. Curtiss and the sailplane in his hand. The plane "floated" along with only an occassional pull from Mr. Gilmore. At the end of the trip, Mr. Curtiss cut loose and "sailed" to the entrance of the hangar.

The Curtiss sailplane is a miniature N. C. boat, the huge craft which were the first to fly the Atlantic. Its dimensions are—Weight (empty) 150 pounds; loaded (one man), 310 pounds; span, 28 feet; chord, 60 inches; gap, 54 inches; length over all, 22 feet 11 inches; wing area, 267.5 sq. ft; hull, 13 feet 2-¼ inches long, 30-inch beam. The hull is made of duralumin. The glider is designed to fly at twenty miles an hour.

The Curtiss Sailplane

The Latest Commercial Machine for Economic Transportation

THE airplane illustrated below was designed and constructed at Omaha, Nebraska, by Mr. G. M. Bellanca, assisted by a number of business and professional men interested in the development of aviation.

The machine has been under almost continual test performance since the beginning of June, including attendance and participation in Airplane Meets in three States, including the Monmouth Meet in Illinois and the Tarkio and Norfolk Meets in Missouri and Nebraska.

The remarkable performance of this machine has created much interest in aeronautical circles and places the ship in a class among the best designed monoplanes of the day.

The general specifications of the Bellanca C F-5 are as follows:

Type—Cabin monoplane carrying four passengers and pilot.

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Span upper plane....................40 ft.
Span lower plane..................22 ft.
Chord lower plane............6 ft. 6 in.
Total wing area............290 sq. ft.
Length overall................23 ft. 10 in.
Heighth over all................7 ft. 7 in.
Weight empty....................950 lbs.
Useful load......................1040 lbs.
Weight loaded..................1990 lbs.
Weight per sq. ft.................6.85 lbs.
Pay load, exclusive of gas and oil for 600 miles, and pilot..........680 lbs.

Performance.

Light load 1200-lbs.

Max. Speed............109.8 M. P. H.
Min. speed....................40-M. P. H.
Speed Range......................3.7 to 1
Climbing rate per min.............1100
Climb in 10-minutes..........7000-ft.
Min. effective hp. required for horizontal flight....................14-H. P.

Full Load

Max. speed................108-M. P. H.
Min. speed.................40-M. P. H.
Climbing rate per minute......600-ft
Climbing in 10-minutes......5000-ft.
Min. effective H. P. required for horizontal flight..............31-H. P.

Gliding angle............................12 to 1
Capacity of tanks (oil and gas) 38-gal.
Fuel consumption at full speed (oil and gas) ....9.5-gal. per hr.
Range, full speed.................440-miles
Range, cruising speed..........600-miles
Miles to gallon of fuel (oil and gas).....................................16-miles

Some of the note-worthy features embodied by this plane are—its simplicity of design, absence of wires, lightness, economy, quick take-off, low landing speed, high speed attained with a large pay load—low cost of manufacture, maintenance and operation.

Motor

The motor used is an Anzanni 90-H. P. with ten air-cooled cylinders, weighing 385-lbs. Two magnetos,- a Zenith carburetor and double air pump was used. Although the cylinders project a minimum distance from the hood, thereby reducing the parasite resistance, no overheating has been experienced after three-hour periods of continuous flying.

The propeller, especially designed by Mr. Bellanca, is 8-ft. diameter and 8-ft. pitch, mounting at the center an aluminum spinner with louvers, for cooling central parts of the engine.

Wings

The spars are I-section of Port Orford cedar, and project from the inner end of the wings 20 inches, thus forming an attachment of wings to the fuselage. The construction at the center is such that the compression stress is continuous without being transferred through the fuselage.

The wing ribs are a combination of ash, bass wood and cloth, weighing nine-ounces each, and have sustained a sand loading of 700-lbs. each.

The lower wings are much smaller than the main wings, and are attached at intermediate points to the upper wings which cantilever beyond these points.

Fuselage

The fuselage is of box girder construction, having a good steam line form internally reinforced with cables and wires. The cabin accommodates four passengers, although two additional passengers may be carried.

The engine compartment is separated from the passengers in order to be more conducive to comfort.

Three windows are provided on each side of the cabin, and one in front.

Tail Group and Controls

The empennage consist of a fixed stabilizer, to this are fastened the elevator flaps.

The oval shaped rudder with sufficient area insures complete control under all circumstances in landing. Rudder is operated by a foot bar, while the lateral and longitudinal balance is operated by stick control.

Landing Gear

The chassis consist of two ash stream line struts glued together with birch veneer, forming the V shaped type—the whole in combination with the shock absorbers form a light simple construction.

Various Factors and Strength of Parts

The fuselage is designed to take a load of 35-lbs. per sq. ft. at the tail surfaces, stabilizers and elevators with a factor of 2 and proved by various test.

Stabilizers and elevators are made to stand a load of 50-lbs. per sq. ft. and the rudder a load of 35-lbs. per sq. ft.

The landing gear has a factor of 8.

The factor at the cantilever on wings in rear spar is 9—the weakest point, while the front spar at this point is 10.5.

The factor for reverse air load is 5.5. The factor for load lifting on 1/4-in. cables is 14.

L. D. on upper wing is 20; L. D. on lower wing is 16.4.

L. D. combined wings (upper and lower wings) and resistance of wires and struts is 18. The advantage of this combination compared with internal braced wings may be readily seen.

Actual Performance

This machine won first prize in four contests at Monmouth, Illinois. It covered in the speed contest the 15-mile triangular circuit in 9-min. 15-sec. The second best machine with 150-H. P. motor covered this course in 11-min. 30-sec. This course was covered in another contest by an S. V .A. (220-H. P. SPA) in 8-min. 33-sec.

The trip from Fort Crook to Mon-

The Bellanca C-F 5

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mouth via Des Moines, 301-miles, was made in 3-hrs. 11-min. against a head wind, averaging 95-miles per hour, with a consumption of 21.5-gal. of gasoline.

This machine made a cruising speed on this trip of 95-miles per hour, with 14-miles per gallon of gasoline. Without the head wind this machine makes 16-miles to a gallon of gasoline.

The Bellanca CF in the gliding contest required 4-min. 43-sec. to descend from an altitude of 2,000-ft. covering a distance of 4-½-miles with a gliding ratio of 12 to 1. The nearest competitor required 3-min. 44-sec.

The climbing contest showed that the Bellanca CF climbed 7,000 ft. in 11-min with a 150-h. p. motor attained only 6,000-ft. in 14-min. While the third machine attained only 5600-ft. in 12½-min.

The Bellanca CF can be assembled ready to fly in 30-minutes due to its simplicity of construction.

The machine participated in two other Meets, one at Tarkio, Mo., and the other at Norfolk, Neb. At Tarkio the machine won 1st prize in three events entered, which were silver cups and at Norfolk it won 1st prize in all the flying events of the Meet; namely one silver cup and $400 cash. In many events at Norfolk the machine showed better performance than it did in the Monmouth Meet.

Aeronautic Progress in Canada

By E. G. Wilson

THE question of civil aviation is receiving no little attention in best be illustrated by a reference to the work being done by the Canadian Air Board in preparing mosaic maps of industrial regions and large engineering projects. The main purpose of the air service in Canada is to develop and train aviators to meet the needs of national defence in the future, and for that purpose a great deal of experimental work and training of men in air operations has to be carried out. It has been found feasihle to promote this training simultaneously with performing valuahle services to the civil branches of the government and to the cities and towns. In the reports of the Air Board it is shown that it carries out experimental aerial surveys and considerable research work in connection with the development of aerial photography.

The board rendered considerable service to those who are making a study of the project to deepen the St. Lawrence river, and to create a vast supply of hydro electric energy for use of the United States and Canada. It has made mosaic maps of important industrial areas and large canals. It has provided maps of cities and towns for the purpose of facilitating the work of preparing comprehensive plans of urban developments. These mosaic maps cover the whole of the metropolitan areas surrounding cities. The oblique photographs which can be obtained in England are interesting, but are not nearly so valuable for practical purposes as the mosaic maps taken vertically from the air. These maps are not accurate enough to take the place of the ground survey, but are of great value in giving details and in presenting a bird's eye view of physical conditions

Recently, when the project of changing the Air Board into the defence ministry was before the Government, Mr. Thomas Adams, town planning adviser to the Canadian government, submmitted a statement to Premier W. L. Mackenzie King, drawing attention to the valuable work which the Air Board had done, and was doing. In this statement attention was drawn to an aerial survey that was being made of a proposed national park. It was indicated that the survey would save a considerable sum of money, and give an impression of the country that would be unobtainable by any other means. The premier replied that he was sure the ministry of defence would be the first to see that any changes would not operate against the fullest utilization of the air services for civil purposes.

The widespread aerial activities in Canada show that flying is no longer an exceptional feat, but is becoming gradually an ordinary phase of transportation. The steady progress made by the firms employing aircraft as a subsidiary to their main operations is perhaps the most gratifying of the operations during the past year. In the province of Quebec several of the large pulp and paper companies are now employing aircraft regularly in connection with their forestry work, for survey, fire protection and transportation within their limits. The success attending such developments gives promise of a steady outlet for commercial flying.

In its annual report, just recently issued, the Air Board has the following to say concerning the present status of civil and commercial flying operations in the Dominion: "Considering the progress as a whole there is no need for discouragement. Aviation is passing through a normal phase of its development. The boom period following the war is dying down. Consolidation is taking place and experience is showing those operations which will prove not only profitable, but of value to the community as a whole. This phase will continue for a further period of years, during which the more temporary phases of flying will disappear and useful forms of work will be gradually developed. The opportunities for commercial flying in Canada, are unequalled in any part of the world. Development takes time and financial conditions are adverse, but those interested in aviation may look forward with confidence to steady progress along sound lines. The work done by the pioneers will reap its reward and with the production of more efficient types of machines and engines, there is no doubt but that aviation will play an increased part in the development and conservation of the recources of this Dominion.

"Mail and passenger services will follow more slowly as the present forms of transportation are efficient, highly developed and serve their purpose well. As an auxiliary to these services aircraft already play some part and a great opening exists here, especially in regard to summer tourist traffic. As the public gains confidence in flying, the demand for faster mails will become insistent and air mail passenger and express services will follow.

"The greatest need in aviation today is the creation of public confidence. This is essential to progress and, so long as it is lacking aviation cannot succeed. This cannot be gained by freak operations or stunts, however brilliant, but only by strict adherence to business principles and conservative operations on the part of aviation executives and careful flying on the part of pilots."

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THE NEWS of THE MONTH

Convention Fifth District N. A. A.

The first convention of the Fifth District (Ohio, Indiana, Kentucky and Virginia) of the National Aeronautic Association of the United States was held at Cedar Point, Ohio, August 25 and 26.

Maj. Alfred W. Harris, Cleveland Chairman, welcomed the Detroit and Cleveland delegations who arrived from the air, also extended a welcome to all delegates. Seventeen cities were represented.

Hugh W. Robertson, Executive Committee, Detroit Aviation Society, gave details of arrangements for National Aero Congress and Pulitzer Races at Detroit, October 12-13-14. The Chairman replied pledging support of large delegation from Fifth District.

Lt. Col. H. E. Hartney, Executive Sec'y. National Aeronautic Association, Washington, D. C. spoke, praising liberal assistance shown by Mr. Howard E. Coffin, in particular, and others in general, in assisting his work.

Outlined official standing of Air Boards.

Gave instructions to delegates how to form their own air Boards on returning to their cities.

"Aeronautics cannot be a one man proposition—Air Boards solve all local questions for aviation".

Mentioned Squadron Re-Unions for national convention and also Field Reunions. Army and Navy and Lighter than Air reunions.

Arthur Halstead, Sec'y. Sectional Committee. Bureau of Standards, Washington, D. C., outlined the work which the Bureau and the Society of Automotive Engineers are doing in compiling the American Aeronautical Safety Code. This will form the nucleus for the Board of Aeronautics, when formed, to work with. A resolution later was passed, endorsing the work of this Department and the Secretary instructed to forward copies of same to the Bureau of Standards, and Society of Automotive Engineers.

Howard E. Coffin, of Detroit, Mich. spoke at length on the intensive study covering a number of years which he personally had given the subject of aviation. He emphasised the necessity of having a National Association from similar experiences in the automobile and Good Roads developments. Omitting the technical side of the question which he said would take care of itself, the two main factors in holding up the development of aeronautics to-day are: (a) Fear of riding in planes (coming from ignorance) (b) Lack of Legislation (federal, state and municipal).

He deplored the inactivity of Congress in passing laws already drafted, and predicted government subsidy or aid for the commercial airplane industry. He painted a word picture of future Pulitzer races, predicting eliminating trial meets in all sections of the country preliminary to the great flying classic, at which time the various district organizations could convene and elect their delegates to the National Aero Congress.

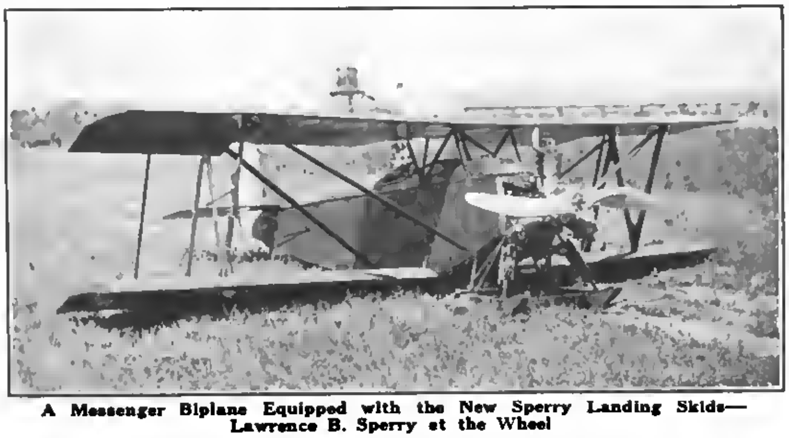
William B. Stout, Designer and Manufacturer, Detroit, also addressed the meeting reciting some of the problems confronting the aeronautical interests today. He pledged active co-operation to the national body. He also stated that the Technical development was keeping place with the times.

Harvey Campbell, Secretary, Board of Commerce, Detroit, Mich. gave a brief outline of what the "Dynamic City" was preparing to do for the National Aero Congress and assured delegates that they would be well taken care of in Detroit. He stated that Detroiters were convinced that Aircraft is the next important industry and urged everyone to get in behind the movement for the N. A. A.

He deplored the adverse publicity methods of the press and suggested the addition to all crash stories (in black face type) "This is another example of the vital need of adequate Federal Legislation."

It was unanimously decided to postpone election of permanent officers, and ask the temporary officers to continue to carry on until the next meeting in Detroit, October 11th., the day preceding the National Convention.

During the session flying boats "Buckeye" and "Wolverine" of the Aeromarine Airways Company, flying boats of Messers. Long, of Lorain, and Audregg Bros. of Mansfield, Ohio, the "Great Lakes" cabin cruiser, of the Great Lakes Airways Company, Cleveland, Ohio, and "Waco" three passenger airplane of Weaver Air-Cedar Point during the conven-craft of Medina, Ohio, flew in to tion.



A Messenger Biplane Equipped with the New Sperry Landing Skids—Lawrence B. Sperry at the Wheel

International Aero Show To Open in Paris Dec. 15

Arrangements have just been completed for an Eighth International Aeronautical Exposition to be held in Paris between Dec. 15, 1922 and Jan 2, 1923, in the Grand Palais des Champs-Elysees.

The classification of exhibits

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hydroplanes, helicopters, gliders, provides for balloons, airplanes, motors, aerial navigation, metallurgy and construction materials with reference to aeronautical use, methods of manufacture, transportation and maintenance of aeronautical machines and apparatus, meteorology, aerial physiology, photography, cinematography, map making and bibliography.

Prospective exhibitors may obtain detailed information from the Commissioner General of the exposition, Andre Granet, No. 9 Rue de la Forge, Paris.

Co-operative Engine Test

The Post Office Department, the Navy and the Army have joined hands to make some endurance tests with airplane motors using high compression. The problem of compression in airplane engines, being intimately connected with cost of operation, power and altitude is one of great importance in airplane circles.

The Post Office Department has receiver word that the first of the high compression pistons lent by the Army and Navy Departments, have been installed in planes flying on the Cheyenne to Salt Lake City leg of the trans-continental air mail route. There where the altitude is 6,000 feet and planes often have to fly more than 9,000 to top the mountains, the rarified atmosphere lends itself to the use of high compression motors.

The equipment loaned by the Navy will have 6 to 1 ratio while the Army pistons are designed for 6.5 to 1 compression.

Ordinarily airplane engines use a five to one ratio of compression. At sea level with an atmospheric pressure of 14.7 these engines will function at rated horsepower. However, in the higher altitudes where the air pressure is lighter the compresson is necessarily less and the efficiency is cut considerably. Engines fitted with high compression for high altitudes knock at low altitures. The Army and the Navy have long been experimenting to overcome the difficulty in order to increase the power of their machine in high flying. One of the developments has been an anti-knock fuel. The Army and the Navy, however, have no opportunity for sustained tests as in the case with the Air Mail Service. Moreover the high elevation of parts of the western route are better suited to high compression engines. For this reason, the tests will be made to determine if an increase in speed and carrying power can be secured and if the engines will function well under such compression.

Aero Club of Pennsylvania

The stated monthly meetings of the Club for the coming season will commence with the September meeting which will be held at the Engineers' Club, 1317 Spruce Street, Friday Evening, September 15th, at 8 o'clock sharp.

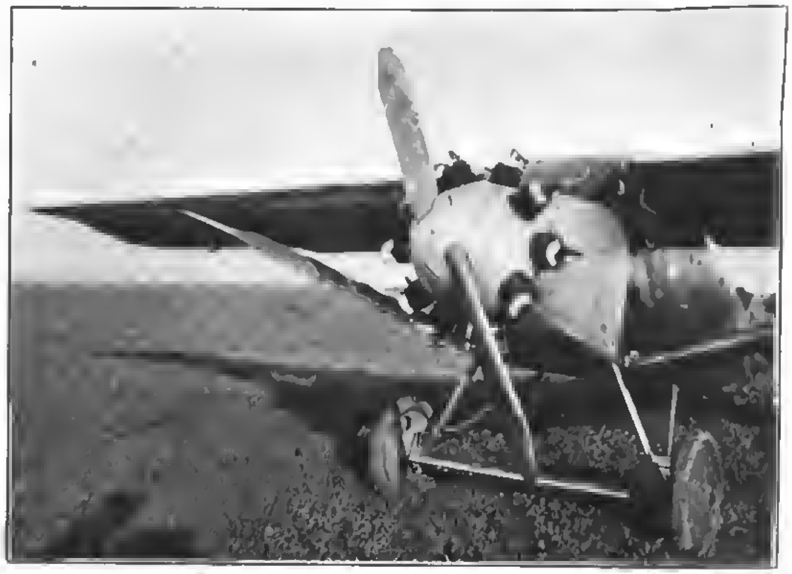
To all of our members it will come as sad news that our beloved Secretary, Dr. George S. Gassner, died August 25th. As one of, if not the oldest member of our Club, he has been the most active and hardest worker of our organization; a founder member and the one remaining tie to the early history of the Club. It is the expression of our entire membership that his loss will be keenly felt by our Aero Club and his host of friends who held him in such high esteem.

It is hoped that every member of the Club will make a special effort to attend this opening meeting and discuss freely plans and ideas for the coming season. It is planned that in the future, monthly meetings will be regularly held and that renewed interest and increased membership will result therefrom. The program Committee is planning to map out a most interesting course of lectures on aeronautics by proship gradually but those who have minent engineers, builders and well known pilots. If sufficient interest can be aroused, a model contest will be held early in October. It is also planned to arrange to hold a Field Day Meeting at an early date at the Pine Valley Flying Field—prizes of free aerial rides will be offered new members and a special rate will he extended to all Cluh memhers who desire to take a flight.

New interest in aeronautics is being shown throughout the country and increasing activity indicates a slow but steady growth of the business. The reports of the great commercial air lines conducted in this and foreign countries and of the U. S. Air Mail Service, of millions of miles flown during the past year without accident, shows conclusively that air travel on these lines is practically safe, if not even safer, than any other mode of travel; with almost equal comfort and in half to a quarter of the time.

Let us turn out in full force and have a well attended meeting, discuss our plans for the future, talk over with the Program Committee plans to interest and bring out the members. It is not too early to discuss who we want for officers for the coming year and many of the older officers feel that they should be retired to the Board of Directors and that the new members be put in charge. Our Club is in a good healthy financial condition and increasing in memberheld office for many years helieve that those who have lately joined our ranks are entitled to the honor of holding office and building up the Club.

JOSEPH A. STEINMETZ
President



The Ballancer CF-5 described on page 503

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THE AIRCRAFT TRADE REVIEW

Aeronautical Chamber of Commerce Elects Officers

AT the annual meeting of the nautical Chamber of Com- Board of Governors, Aero- erce of America, 501 Fifth Avenue, the following officers were elected: President, Inglis M. Uppercu, Aeromarine Plane & Motor Co., Keyport N. J.; First Vice-President, Charles L. Lawrance, Lawrance Aero-Engine Corp., New York City; Second Vice-President, C. C. Witmer, Airship Manufacturing Company of America, Hammondsport, New York; Third Vice-President, Lawrance B. Sperry, Lawrence Sperry Aircraft Co., Farmingdale, L. I.; Treasurer, Charles H. Colvin, Pioneer Instrument Company, Brooklyn N. Y.; General Manager and Assistant Treasurer, S. S. Bradley; Secretary, Luther K. Bell; Assistant Secretary, Owen A. Shannon.

Increases in the Board of Governors from eleven to fifteen were made as follows: I. M. Uppercu; G. M. Williams, General Manager, Dayton Wright Company, Dayton, Ohio; W. C. Young, Goodyear Tire & Rubber Company, Akron, Ohio; Charles L. Lawrance.

Steady growth by the Aeronautical Chamber of Commerce was reported; recent additions to the membership including Goodrich Rubber Co., Akron, Ohio; Goodyear Tire & Rubber Co., Akron, Ohio; Wolverine Lubricants Co. of New York, New York; Rich Tool Co., Chicago, Ill.; Mosler Metal Products Corp., Mt. Vernon N. Y.

Baldwin Aircraft Corporation

The Baldwin Aircraft Corporation recently obtained possession of the well equipped plant and other manufacturing facilities of the Ordnance Engineering Corporation and is now in a position to execute orders for aircraft, aircraft parts and for any class of machine shop, sheet metal and wood work. Its plant is located in the center of an established aircraft community about one hundred feet from the Baldwin Station on the Montauk Division of the Long Island R. R. and may be reached in forty-five minutes from New York City. In addition to having an ideal railroad location the plant is at the junction of two highways and about midway between Mineola and Far Rockaway, consequently both land and water machines can be conveniently received and delivered by air.

Mr. William F. Bennett, formerly Secretary and Treasurer of the Lewis and Vought Corporation, is President of the Baldwin Aircraft Corporation and Mr. John J. Rooney, recently Engineer and Production Manager of the Chance-Vought Corporation, is General Manager.

The Loening Air Yacht for the Wright Aeronautical Corporation. The illustration also shows the Engine Doorway to the Loening Factory, which enables shipment without taking down the Machines

A New Curtiss Aviation School

During the last two years the Curtiss Company has felt a growing demand for a flying school which would not only teach a man to solo, but would give him a chance to acquire enough time after his preliminary training to give him experience. It is a recognized fact that a young man of average ability and intelligence, in proper physical condition, can learn to fly sufficiently well to handle a machine in safety in a period of six to ten hours of flying instruction, and it is this instruction that commercial schools have been able to give. However, to send a pilot on a commercial job with this amount of training is suicidal, and no commercial company would consider employing him. Consequently, there has been little incentive for a young man to attend a flying school under these conditions (if he knew them) and the problem has been to supply this fifty hours of flying in which a student can acquire the experience necessary to make him a capable pilot without too great expense. To date no school has been able to do this, and few students are able to afford the three thousand dollars that such training would cost.

With this in mind, the Curtiss Aeroplane and Motor Corporation has arranged, through the Curtiss Exhibition Company, to operate its Aviation School at Garden City, L. I., offering the following inducements to students with the idea of solving the above problem:

A flying course in ten hours.

Eight weeks intensive training in aeroplane mechanics and its auxiliary subjects.

A complete Radio course.

Presentation to graduates of a JN aeroplane equipped to take OX motor, less motor.

The cost of the complete course, including flying training and the aeroplane, will be five hundred dol-

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motors are available throughout the country at reasonable prices, so that at a minimum cost a student can get his preliminary training, together with an aeroplane, on which he can acquire the experience mentioned above, at the cost of his gas and oil, and become a pilot capable of demanding a good position. In fact, after a little practice, he will be able to use his machine for passenger carrying, advertising, etc., with a good chance of fair profit together with his training.

A part of the work in the school will be the reconditioning of the machine and overhauling of motors by the students themselves under competent supervision. This will familiarize them with their own machines and give them practical training that no other method could give.

Furthermore, classes will be given to a limited number in aeroplane and motor work alone, at a cost of one hundred dollars, and those attaining the required standards will be placed in the Curtiss Organization. Plans are under way for a Club where the students can get room and board at minimum rates.

The Curtiss Company believe that this scheme will fill a long felt want and will go a long way towards popularizing and commercializing aviation.

Woman Buys First Aerial Commutation Ticket

The unique distinction of being the first woman to purchase an aerial flight commutation ticket has fallen to Miss S. D. Winter, sales manager of the Motor List Company of Cleveland.

Miss Winter's main office is in Detroit and she has occasion to go over to the Michigan City two or three times a week. Several days ago friends persuaded her to try the aerial route and she flew over in the "Wolverine," eleven passenger flying boat; one of a fleet now being operated by the Aeromarine Airways on a daily schedule between this city and Detroit. Upon the completion of her first aerial voyage, Miss Winter asked the passenger agent of the company if she could purchase a commutation ticket at a special rate. The regular fare for the round trip is $75. The passenger agent recently issued her a ticket at the Aeromarine Booking Office in the main lobby of the Hollenden Hotel. This ticket calls for 14 round trip flights at the special rate of $50 per round trip.

When asked why she had chosen the air route Miss Winter said:

"Time is a great element in my business. It did not take me long to realize that I could save practically one day and two nights by flying over to Detroit and returning the same day. And there is another angle to it too—I tell my prospect that I just flew in to get his order and I generally get it."

The double daily flying boat service between Cleveland and Detroit is being well patronized by the citizens of both Lake cities.

WRIGHT E-2 ENGINE TEST

As a result of a recent test conducted on an E-2 Wright engine, the Navy Department announced the possibilities of a marked increase in the power and dependability of aeronautical engines designed for use in scouting-type planes.

The test was held at the Anacostia Naval Air Station. The engine ran through 250 hours with the throttle open. The demonstration, it was said, may pave the way for all aviation engines not only to pass through long periods of running but to do so with their full rated power.

The department considers the feat of great importance in lengthening the range of scout planes and increasing their dependability to make an extended reconnoissance and return to their battleship base. The planes which are catapulted from the decks of battleships are equipped with the Wright engines.

M. A. A. Elects Officers

At the Annual Meeting of the Manufacturers Aircraft Association, Inc., the following directors were elected: A. H. Flint, L. W. F. Engineering Co., College Point, L. I.; F. L. Morse, Thomas-Morse Aircraft Corporation, Ithica, N. Y.; F. B. Rentschler, Wright Aeronautical Corporation, Paterson, N. J.; J. K. Robinson, Jr., Gallaudet Aircraft Corporation , East Greenwich, R. I.; F. H. Russell, Curtiss Aeroplane & Motor Corporation, Garden City, L. I.; I. M. Uppercu, Aeromarine Plane & Motor Company, Keyport, N. J.; J. G. Vincent, Packard Motor Car Company, Detroit, Michigan; C. M. Vought, Lewis & Vought Corporation, Long Island City, L. I.; G. M. Williams, Dayton Wright Company, Dayton, Ohio.

Officers were elected as follows: President, G. M. Williams; Vice-President, F. B. Rentschler; Secretary, Chance M. Vought; Treasurer, F. H. Russell; General Manager and Assistant Treasurer; Samuel S. Bradley.

Remarkable Piston Ring Sales

The fact that The Piston Ring Company of Muskegon, Michigan has only been going after replacement business for less than a year, attaches special significance to the recent production record of 5,232,031 QUALITY Piston Rings during two consecutive working months. Although the Piston Ring plant is the largest exclusive piston ring factory in the world with its capacity of 12,000 rings per working hour, there is every reason to believe that further expansion will soon be necessary to keep abreast of the ever-increasing demand for QUALITY Piston Rings.

500 Civilians Learning How to Fly

According to reports compiled by the Aeronautical Chamber of Commerce, approximately five hundred persons are being taught to fly at the score or more of flying schools located in various parts of the United States. Among the leaders in civilian flying instruction are New York, Chicago, Dayton, Ohio, San Francisco, and points in Missouri, Oklahoma, and Texas. Most significant returns are found in Dayton, Ohio, "The birthplace of the airplane", where at the field of the Dayton Wright Company, 4000 inquiries have been received this summer from civilians who are desirous of learning the requirements and cost of instruction in flight.

No Chicago Meet This Year

Under the date of August 26th the Chicago Aeronautical Bureau advises Aerial Age as follows:

"We regret to be compelled to advise you that causes beyond our control have made it necessary to postpone until next year the Air Program originally scheduled to be held in Chicago from August 4th to 13th, inclusive, under the auspices of the Chicago Aeronautical Bureau.

"Believing you will be interested in knowing the reasons for this postponement we wish to explain that formal permit has been issued by the South Park Commissioners for the use of Grant Park on the

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Grant Park which had temporarily been held in abeyance for us could not be longer delayed, and this work made it impossible for a considerable time to use the space set aside for a landing field.

"As we consider Grant Park the only place in or near Chicago where such a Meet could be successfully held, we were reluctantly compelled to abandon our plans until next year. The Chicago Aeronautical Bureau will commence preparations in February, 1923, for the holding of its Air Pageant during the first two weeks in August. With plenty of time and money at our disposal we expect to make it the greatest affair of its kind ever held. It will include not only a large number of flying events with liberal cash prizes, for the various classes of planes, but also an exhibition of aircraft and aircraft parts and material, as well as an Aeronautical Congress with addresses by the country's foremost authorities on the various phases of aeronautics.

"In the meantime the Chicago Aeronautical Bureau (incorporated not for profit) will actively continue its work in educating the public to the commercial possibilities of aircraft and in advancing Chicago's aeronautical interests in every way.

"We wish to thank you for the interest you have shown in the plans for our Air Program, and will advise you fully as soon as the dates are definitely fixed for next year, when we hope to have you with us."

Frostburg Landing Field

The city of Frostburg, Md., has established and improved, at considerable labor and expense, a landing field about 2½ miles southeastward of that city. The improved part of the field as it now stands is 1,200 feet long by 1,000 feet wide, having sufficiently clear approaches to make it available for most of the present type planes.

The field is marked by a circle, 100 feet in diameter, with a band 3 feet wide, painted white. This marker indicates the center of the best landing area. A wind cone has been erected to indicate the direction of the wind.

The location of this field at Frostburg, in the center of a country where landing fields are few, is an important addition to the model airway, located as it is midway between Washington, D. C., and Moundsville, W. Va.

Approximate position, latitude 39° 40' N., longitude 78° 65' W.

The booking office of the Aeromarine Airways in the Main Lobby of the Hollender Hotel, Cleveland.

Oxygen Instruments

This report (No. 130), by F. L. Hunt, of the National Advisory Committee for Aeronautics, contains an introductory discussion of the physiological effects of the lack of oxygen at high altitudes and the amounts required to be supplied artificially to aviators under normal conditions of flight. It discussed in detail the various types of aircraft oxygen apparatus which have been designed and used not only in this country, but also in England, France, and Germany. Instruments of both the compressed oxygen and liquid oxygen type are considered.

Methods of testing oxygen apparatus used at the Bureau of Standards are also fully described and the quantitative results of tests of sample instruments of different types are given.

A copy of Report No. 130 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D.C.

The Pressure Distribution Over the Horizontal Tail Surfaces of an Aeroplane, III

Report No. 148 by F. H. Norton and W. G. Brown, of the National Advisory Committee for Aeronautics deals with the distribution of pressure during accelerated flight of the full-sized aeroplane, for the purpose of determining the magnitude of the tail and fuselage stresses in stunting.

As the pressures to be measured in accelerated flight change in value with great rapidity, it was found that the liquid manometer used in the first part of this investigation would not be at all suitable under these conditions; so it was necessary to design and construct a new manometer containing a large number of recording diaphragm gauges for these measurements. Sixty openings on the tail surfaces were connected to this manometer and continuous records of pressures for each pair of holes were taken during various maneuvers. There were also recorded, simultaneously with the pressures, the normal acceleration at the center of gravity and the angular position of all the controls.

The present investigation consisted in measuring on a standard rigged JN4H aeroplane the distribution of pressure over the whole of the horizontal tail surfaces while the aeroplane was being put through maneuvers as violently as it was thought safe, including spinning and pulling out of dives.

A copy of Report No. 148 may be obtained upon request from the National Advisory Committee for Aeronautics. Washington, D. C.

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ARMY and NAVY AERONAUTICS

Marine Corps Demonstrates.

A demonstration of the work of the 4th Air Squadron, U. S. Marine Corps, before a distinguished party of guests was held at Bowen Field, Port-au-Prince, Republic Haiti, during the early part of August, and illustrated the important part that aviation has come to play in the work of policing the troubled parts of the Carribean.

The party in honor of whom the exhibition was given included The U. S. High Commissioner to Haiti, the President of Haiti, and his cabinet, the Chief Justice, the Chief of the Gendarmerie D'Haiti, the Chief of the Engineers and the Sanitary Service and the Mayor of Port-au-Prince.

The program included a formation flight of D H 4 B's, a demonstration of the use of the ambulance plane attached to the squadron, radio communication with plane in the air, practice bombing and gunnery flights, parachute jumping, and an exhibition of stunting and a "dog fight" between two J N planes.

The exhibition was staged in the presence of an audience of two thousand persons.

The unsung praises of the Marine Aviation units in Haiti and San Domingo does not affect the fact that this important branch of the service has done and is doing an important work in the far flung reaches of the tropical jungle toward the establishment of peace and good order. The airplane patrol established over the island republics has been the means of seeking out and checking incipient revolutionary movements in numberless instances in a manner that would have been well nigh impossible through the use of scouting units of infantry. As a means of communication between widely separated posts throughout the island the aviation have proved invaluable. And in addition to the military uses of the airplane the ambulance service established by air through the use of a specially equipped ambulance plane has brought to the service of outlying posts the last word in speedy medical assistance and has been the means of saving lives not only of members of the expeditionary forces but of any and all who might have need of medical assistance.

Conclusion of R.O.T.C. Students' Camp at Mitchel Field.

Twenty-three R. O. T. C. students from the Massachusetts Institute of Technology, who have been in camp at Mitchel Field for the past six weeks, departed from that station on July 26th. Major J. C. McDonnell and Captain Wm. B. Wright, Air Service, who were in duty at this station in connection with this camp and who have been for the past year instructors in the R. O. T. C. Unit of the above institute, remained at Mitchel Field to assist in the training camp for Reserve Officers which was already in progress at the conclusion of the R. O. T. C. Camp.

New Altitude Record in Bombing Machine.

Ascending to an altitude of 23,350 feet in a Martin Bomber, Lieut. Leigh Wade, test pilot at McCook field, Dayton, Ohio, broke his own altitude record made several months

An interesting Group at the Gordon Bennett Balloon Race at Geneva

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ago for an airplane carrying three passengers. Lieut. Wade performed his latest feat on August 1st., and he was accompanied by Captain A. W. Stevens, aerial photographer, and Sergeant Roy Laugham, observer.

The bomber was equipped with a Moss supercharger.

Contrary to most altitude trips, this flight was without any unusual incident. The temperature was slightly below zero, while a wind, estimated at 100 miles an hour, was recorded. The flight took 2 hours and 15 minutes. One hour and 52 minutes elapsed before the ship reached the ceiling, while only 23 minutes were required for the return trip.

Lieut. Wade believed that with several minor adjustments he can climb the Bomber to a higher altitude.

Aerial Observation School Makes Fine Record.

The most thorough course in flying ever given to any Air Service class terminated at the School for Aerial Observers, Post Field, Fort Sill, Oklahoma, on June 30, 1922.

The course opened January 16, 1922, with 3 Captains, 11 First Lieutenants, one cadet from the Regular Army and one foreign officer, Lieut. Shen from the Chinese Navy. The only changes in personnel during the course were as follows: On February 14th, Cadet Wright crashed and was killed; on March 15th Lieut. Zuniga Cooper, of the Chilean Army, was transferred to the Observation School from the Communications School; and on April 12th Lieut. R. L. Williamson was assigned to the School from Carlstrom Field. On June 30th the School graduated 15 regular officers and two foreign officers.

The subjects covered in the course were Liberty Engines, Rigging, Artillery, Contact, Photography, Visual Reconnaissance, Radio, Army Regulations, Infantry Contact, Minor Tactics, Rules of Land Warfare, Gunnery and Flying. The technical part of the course was given in the Rigging and Motor Shops, and the theoretical part in the class rooms.

The remarkable thing about the course was that, in spite of the great number of flying hours, there was only one fatal accident, and that occurred in the early stages of transition work.

Night Flights of the AirshipC-2.

The night flights recently made by the Airship C-2, one from Aberdeen, Md. to Philadelphia, Pa., and return, and the other from Bolling Field, Anacostia, D. C., to New York City, and return to Aberdeen, served as an ample demonstration of the ability of airships of this type to successfully negotiate long distance flights despite unfavorable weather conditions, and that they can be navigated sufficiently close to the ground to pick up lights and land marks under such conditions, even when confronted by fog and rain, with relative safety to the passengers on board and to people on the ground.

The first trip, the purpose of which was to make a night practice flight in order to give the crew some good experience in handling the ship at night preparatory to the trip to New York City, and at the same time to test the new type of bomb rack which is being installed on the ship, was started from Aberdeen Proving Grounds at 6:00 p.m. The crew on board consisted of Major James A. Mars, Captain W. E. Kepner, 1st Lieut. E. S. Moon, Lieut. R. J. Parker, R. O. T. C. and Sergeant A. D. Albrecht. The bombing was conducted from an altitude of 2,000 feet, dummy bombs being used, one weighing 300 lbs. and the others 100 lbs. The bomb rack functioned satisfactorily.

Upon concluding the bombing practice, the ship proceeded on a cross country flight to the Delaware River, and thence up this river to the vicinity of Philadelphia, Pa. It returned via. the same route and arrived at Aberdeen shortly after 11 p.m.

In the early evening and for some time after dark, land marks were easily discernable, but around nine o'clock a thick fog was encountered. The wind was quite dusty and rain fell at intervals. At times land marks were very hard to distinguish, and only a few lights were visible. It was necessary to steer entirely by compass, but the course was held very accurately. The radio apparatus on board functioned splendidly, and communication with the Aberdeen Proving Grounds was maintained practically during the entire time of the flight.

The appearance of the ship at night over the various cities and towns en route apparently created considerable excitement, as evidenced by the flashing of small searchlights and the burning of some flares at various times, evidently for the purpose of attracting the attention of the aeronauts. The trip was made in a northeast wind, which was blowing at the rate of about 15 miles an hour, at times rising to a higher intensity, the average altitude maintained being between 1,000 and 1,200 feet.

In commenting on the trip, Major Mars stated that altogether it was a very enjoyable and instructive practice flight, and he sees no reason why a ship of the C-2 type should not operate very successfully at night under average conditions.

On the following day, the C-2 took off from Bolling Field at 4:30 p.m. and arrived in New York City at 11:30 p.m., standard time. Very good visibility was had while over Philadelphia, and the ship flew over the Quaker City about 20minutes. After passing Trenton, N. J., heavy fogs and rain were encountered. Flying across the mouth of upper New York Bay at about 600 feet altitude, the lights of the bay could not be seen, and it was not until Coney Island was reached that any lights were picked up. The ship next flew over New York City at an altitude of 500 feet, but again fogs were encountered and the lights of the city could not be seen. It hovered over the city for about one and one half hours, being alternately in and out of the fog, and while circling the Statue of Liberty it was picked up by the searchlights at this point.

The radio apparatus on board functioned until Trenton was reached, so that while the C-2 was over in New York City no radio communication was possible.

The return to Aberdeen was made without incident and the ship landed at 5:30 a.m. July 28th.

An Aviation Beacon

A representative of the Lawrence Sperry Aircraft Corporation recently visited McCook Field, Dayton, Ohio, for the purpose of demonstrating in connection with night flying a new truck and searchlight combination known as the Sperry Duplex Truck. The purpose of this light is to serve as a beacon to mark landing fields for night-flying airplanes. The light, which is of high intensity (three hundred million candle power), with a reflector measuring 36 inches in diameter, is the same type as that used on battleships at sea, but this is its first adoption for land purposes. By its radiation a landing field should be located from 75 to 100 miles away. The engine of the truck performs double duty, serving as power for the truck when in motion and for the searchlight when the truck is still.

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REVIEW of WORLD AERONAUTICS

A Million Kilometers Without Accident.

One million kilometers (621,370 miles) of flying with passengers, freight and mail were completed by the Royal Netherlands Aeroplane Company on July 22, 1922, says consul Mahin, Amsterdam, in advices to the Department of Commerce.

Not a single accident has occured, the consul reports. This company has a daily service between Amsterdam and Paris and a twice a day service between Amsterdam and London. The distance over each of these routes is approximately 300 miles.

Cross Channel Traffic.

The returns of air traffic on the cross-Channel routes to Paris, Brussels and Amsterdam, during the three months April-June, are now available from the Air Ministry.

During this quarter 764 machines departed from the London Terminal Aerodrome, Croydon, and 768 machines arrived, the total number using the aerodrome on Continental services being 1,532. This is a considerable increase on the figures for the same period last year, when 506 machines departed and 495 arrived.

The majority of machines were of British nationality, belonging to the Handley Page Transport, Ltd., the Instone Air Line, and Daimler Hire, Ltd. The figures by nationality are:—British, 915; French, 228; and Dutch, 189. Last year British machines numbered only 246 out of a total of 1,001 machines using the aerodrome.

The total number of passengers carried during the period was 3,128, and is a slight decline on the total of 3,565 carried a year ago. The proportion carried by British companies has, however, greatly increased, 2,402 travelling in British machines against 1,653 in the same period last year. British traffic therefore amounted to 76.8 per cent. of the total, whereas last year it was only 46.4 per cent.

The total weight of goods carried by aircraft to and from Croydon was 144 tons, which is a large increase on last year, when the figure was 56.9 tons. Half of this total was carried by French machines, but the British share of the traffic shows the largest proportionate increase, 53.6 tons having been transported by British machines against 4.9 tons a year ago.

The efficiency of British air service continues to be of a high standard. In April the efficiency of flights made and completed within four hours by British machines on the London-Paris route was 92.3 per cent. For May the figure was the same, and for June it rose to 95.2 per cent. The figures for French machines during the same period on the same basis were:—April, 71.3 per cent.; May, 85 per cent.; and June, 79.1 per cent.

Not withstanding these figures it has to be noted, however, as stated in the last half-yearly report on Civil Aviation, that a considerable increase in traffic is essential if Air Transport firms are to obtain a commercial basis of operation, the passenger accommodation occupied on British machines being only 37 per cent. in April, 30 per cent. in May, and 31 per cent. in June, and the useful cargo capacity used only 44 per cent. in April, 44 per cent. in May, and 40 per cent. in June.

Italian Airplanes and Airships in Brazil.

The Minister of War, Hon. Soleri, has decided to send a series of the most modern airplanes and hydroplanes to the International Exposition of Rio de Janeiro.

He has also decided to send several types of small airships, that have been experimented with success, during the last stages of the war and after the Armistice.

The planes will be furnished by the Army and will be piloted by Aviators of the Air Service.

The Hon. Soleri has forwarded a circular to all the Italian Constructors of Airplanes and Airships inviting them to send the most modern types of planes to the Capital of Brazil, in order to uphold the prestige of Italian Aviation.

Napier Performance.

The Napier-engined D.H. 34 machines at present used by the Daimler Airway Company carry out a double return journey between London and Paris each day, and during the month of June for the first time in one week this double return journey was made each day for five days by the same engine and machine, and it says much for the reliability of the 450 h.p. Napier engine that at the end of the week —after having completed 4,600 miles in that week—it was running as smoothly and efficiently as ever.—London Financial TIMES.

France—Spain Postal Service.

It is announced that the Spanish Government has given its consent to the inauguration of an aerial postal service between France and Spain. An agreement is being drawn up between the Spanish Government and the Latecoere Company, which will undertake the transport of mails to and from Spain by utilizing the airplanes already plying on the Toulouse-Casablanca route, which land at Barcelona, Alicante and Malaga. It is also likely that an agreement will be made with regard to the transport of goods by air between France and Spain.

Danish Progress

The Danish Airship Co., having obtained official guaranty for one-half of a possible deficit, is arranging express traffic connections with Central Europe. The company is to take certain mail in exchange for the Government's promise of assistance.

The daily service to Hamburg can take 300 kilos of freight or three passengers, but the route is established only witb the idea of taking freight and mail. Germany will furnish three and Denmark three of the machines used on the Copenhagen-

International Air Traffic Association in Convention at Copenhagen, Denmark

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Hamburg line. The Danish planes are rebuilt and improved DeHavilands.

Another air route, embracing Essen, Brussels, London and Paris, is expected to be opened the 1st of July.

Bristol Performance.

Remarkable results have been achieved in Paris during the tests of an English aero engine by the French Air Ministry. The engine is the 400 h.p. "Bristol" Jupiter radial air-cooled engine, and the performance and reliability shown has never been equalled in France. For five periods of non-stop runs, during which, according to the French official report "the engine behaved itself perfectly and there were no replacements of any sort". For half an hour at the beginning of each period the engine was run at full power—in each case over 400 HP and at nine-tenths full power for the remainder of the period.

These results are the more remarkable when one reflects that if the engine were fitted to an aeroplane, each non-stop period represents over 1,000 miles of travel.

Some few months ago it was recorded that the Jupiter engine had passed the 50 hours endurance tests laid down by the British Air Ministry—the first air-cooled engine to do so.

The French, always keen judges of purposes the tests mentioned were called interested and soon afterwards it was announced that the largest aero engine makers in France, the Gnome & Rhone Company, had obtained the constructional rights for France and neighbouring countries.

Before acceptance for French official purposes the tests mentioned were called for. To the official report is added the remark that the 50 hour period of test might have been doubled so far as the engine is concerned.

These results have been achieved by the makers, the Bristol Aeroplane Co. Ltd. after nearly four years of unflagging research and experiment. The fact that they have now evolved an engine of 400 h.p. weighing only about 1¾ lbs. per h.p. and of unequalled reliability marks an epoch in aviation. The engine is already used in certain of the aircraft seen by the public at the Aerial Pageant and this number will doubtless be increased. Commercial machines with this power unit are also in construction.

British aero engines have deservedly gained a reputation as the finest in the world and the success of the Jupiter engine in France adds yet another link to the chain.

A Siddeley Success.

The Armstrong-Siddeley 325 h.p. radial air-cooled engine known as the Jaguar has just very successfully completed its official Type Test under Air Ministry observation. This particular test was made under the new regulations which call for the whole of the 50 hours' test being made in 10 hour non-stop runs and the Jaguar is the first air-cooled engine—if not the first engine of any type—to pass the British tests under this rule.

The performance on test was most satisfactory, and both fuel and oil consumption were extremely good. Full details of the test and a description of the engine will be given in the immediate future.

Aeronautical Map of Italy

The Secretary of State, recognizing the need of an aeronautical map of the Kingdom, that would offer informations and exact references to aerial navigators; considering that only a public contest would give the best results; hearing the opinion of the Council of State; decides:

Art. 1-To ban a competition for the edition of an aeronautical map of Italy. The conditions are fixed on this brief. All the Italian citizens can participate to the contest.

The following prizes have been assigned to the contest:

1st. prize-Lire 20,000
2nd prize-Lire 10,000
3rd prize-Lire 5,000

Art. 2-The contestants will have to present the original or the lithographic production of the sheet of the future aeronautical map of Italy and precisely the one comprised between 8° and 9° of longitude East Greenwich, 45° and 46° of northern latitude. Said sheet should be countermarked with a motto and addressed to the Ministry of War Superior Command of Aeronautics: Civil Service Section with a sealed envelope bearing the same motto, enclosing a card with the name, surname, paternity, address of the contestant and again the distinctive motto.

Art. 3-The time for presenting the work expires October 31st, 1922. All the works delivered after such date will be returned.

Art. 4-The examination jury will consist of: the Director of the Geographical Military Institute, of a delegate of the Hydrographic Institute of the Royal Navy, a representative of the Aeronautical Inspectorate of the Royal Navy and an authorized member of the National Sport Associations.

Art. 5-The works which will be awarded prizes will become the exclusive property of the Military Administration, who will use them for the edition of the aeronautical map of Italy, making if necessary, changes and additions so that the map will answer better the purpose destined to. The other works will be returned to the owners.

Caproni Metal Plane.

The Caproni firm announces that they have completed a new type of an all metal aeroplane.

This news has met with great favor in the Italian aeronautical circles.

It is said that the public experiments with the new Caproni will be made soon.

Germany's Reply to Restrictions

From Berlin it is reported that the German Government has sent a note to Denmark, Norway, Sweden, Holland and Switzerland informing the respective governments that only aeroplanes conforming with the restrictions placed upon German aircraft will be permitted to cross the German frontier. This is a clever move on the part of the German Government, and obviously intended to reduce the handicap which the restrictions of the Allies places upon German civil flying. If any of these countries wish to run services into Germany they can now only do so by using machines of as low power and fuel capacity as those to which the Germans themselves are restricted.

500-Aeroplane Fleet Planned by Britain

With no limitation of air armaments in sight, Great Britain now plans to build a fleet of 500 aeroplanes for home defense Critics of the extension of the air fleet regard it as putting a premium on air armaments.

Premier Lloyd George announced this big building program in the House of Commons, saying the decision to do so resulted from an inquiry by the Committee on Defense of the Empire. At the present time Britain has thirty-one squadrons, only twelve of which are in the British Isles. France, however, will have at the end of next year fully 220 squadrons, besides several hundred machines which can be drawn from civil aviation in the event of an emergency. It will cost nearly $10,000,000 annually to maintain the new British home defense air force.

The Premier indicated that if necessary there would be a further extension of the air service. It is understood orders for aero engines will be divided among five firms.

Aerial Mail from Germany to Russia

The aerial mail service initiated on May 6 from Hamburg via Stettin to Danzig, Konigsberg, Kovno, Riga, and Moscow, has made a marked reduction in the time required for delivery of mails between Germany and Russia, according to recent dispatches from Consul Huddle, Hamburg. The saving amounts to 24 hours in mail for delivery to Kovno, and 36 hours for mails to Riga. In addition there is a saving of 5 hours time in the Danzig and Konigsberg mails.

A daily service from Hamburg to Kovno is maintained, and from Kovno to Riga the trips of the mail planes are on Tuesdays, Thursdays, and Saturdays. From Konigsberg the planes leave on Thursdays and Sundays to Moscow, the flying time to Moscow being in the neighborhood of 37 hours.

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ELEMENTARY AERONAUTICS *and* MODEL NOTES

THE "COOK 42" HYDRO

THE "Cook 42," designed by Ellis C. Cook, second prize winner in the National Model Aeroplane Competition for hydros and duration record holder for twin-screw hydros, is constructed along orthodox lines. Although designed in the winter of 1914-1915 it was not completed until just prior to the hydro competition. It is of the common "A" frame design with the 1-1-0 P2 wing and propeller arrangement. The float system is of the familiar 0-2-1 system. The model is fairly light, weighing, when complete, 3.33 ounces, of which 1.2 ounce is rubber motor.

Frame and Chassis

The frame is built up of two white pine strips 38¾" long and 5/16" x ⅛" in cross section. They taper towards the ends where they are only ⅛" and 3/16" high in the front and rear respectively. The strips are braced by three "X's" made of 3/16" x 3/64", streamlined. These prevent any bending tendencies in a sideward direction.

The propeller bearings are small streamlined forgings of light weight. They are bound to the frame with thread and coated with a celluloid solution. The front hook is made of No. 16 piano wire bound to the frame.

The chassis holding the floats is made of 3/32" bamboo bent to shape and bound to the frame. The floats are attached to the chassis by rubber bands, the angle of the front floats being adjustable.

Wings

The main wing has a span of 36" and a chord of 5". It is constructed of two white pine beams 30" long with bamboo wing tips. The ribs, seven in number, are also of bamboo and are spaced 4½" apart. The elevator, or front plane, has a span of 14" and a chord of 3½".

The framework of this wing is entirely bamboo. The entering edge is given a slightly greater dihedral than the rear edge, so that the angle of incidence at the center is slightly less than it is at the tips. In this manner the added incidence in the front plane is obtained. Both wings are fastened to the frame with rubber bands.

Floats

The two front floats are spaced 8" apart and are of the stepped type. The step is 3½" from the front and is ⅛" deep. The two front floats are separated by two bamboo strips tied to the rounded portion of the under-carriage by small rubber bands. By sliding these strips back and forth, the angle of the floats may be altered to suit conditions.

The floats are built up of two pieces of very thin pine for sides, separated by small pieces of wood about half the size of a match in cross section. The floats and wings are covered with chiffon veiling waterproofed with a special preparation. This makes a watertight and strong construction without any undue weight.

Power Plant

The two ten-inch propellers with which the model is equipped have a theoretically twelve-and-one-half-inch pitch. They are carved from blanks ½" thick and have blades with a maximum width of 1" at a radius of 3". The shafts are made of No. 16 piano wire, and have small washers for bearings.

Each propeller is driven by three strands of ¼" rubber. The rubber is given about 1,700 winds, and turns the propellers at 1150-1200 R. P. M. when in flight. When not in flight the R. P. M. is considerably less, or about 750.

When in flight the model seems to be somewhat overpowered, although this is not the case. It takes but two or three feet of run to leave the water, and climbs at a very steep angle to an altitude of about 125 feet. The motors unwind in 85-90 seconds, the glide making up the rest of the flight. From a duration standpoint its flights have been very consistent out of six timed flights, four have been between 98 and 100.6 seconds, which is somewhat unusual for a model which makes good duration.

Characteristics and data relating to some of the successful models of Illinois Model Aero Club members:

	Name of Designer and Type of Machine			
	Cook Hydro	Hittle Hydro	Schweitzer Duration	Pease Duration
Wing area (sq. ft.)	1.39	1.5	.92	.92
Total weight (ozs.)	3.33	1.75	1.96	1.61
Wing loading (wgt./area)	2.4	1.17	2.13	1.75
Duration of flight (secs.)	100	116	230.8	207
Weight of rubber (ozs.)	1.2	.6	.88	.68
Resistance factor	4.5	8.75	7	6.3
Thrust, each propeller (lbs.)	.37	.2	.14	.12
Propeller disk area (sq. inches)	137	78.5	266	226
Air pitch speed (ft. per sec.)	20	14.8	......	10
Effective pitch (per cent)	63	59	......	59
Revolutions of propeller	1700	1500	......	......
Lgth. of rubber (feet)	3.33	3.1	3	3
Propeller diam. (inches)	10	10	13	12

Reader of Aerial Age in South America Buliding Novel Gliding Machine.

From Uruguay, South America, a report has reached Aerial Age describing a gliding or soaring plane being constructed by Hector Symonds, a novel feature of this glider which is nearing completion, is the employment of a small engine to give the wings a flapping motion. The design is copied from nature as far as possible, the Eagle being chosen as a model.

Calculations indicate a lifting force of 400 pounds. The dimensions are:

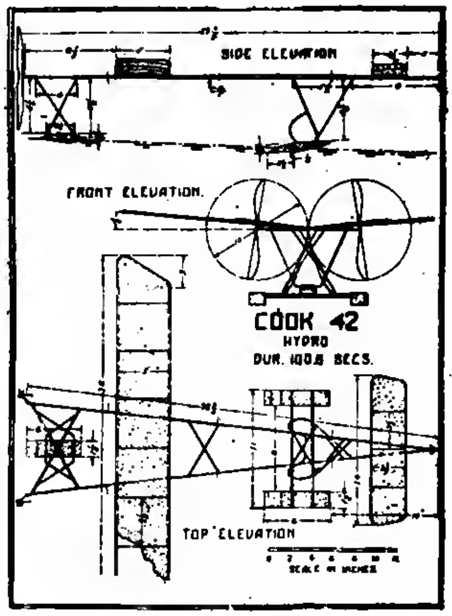
Wing spread, tip-to-tip............42 feet
Length, tip of tail to nose.........15 feet
Height with wheels in position......7 feet
Chord, (min. O Lt.,) maximum....10 feet
Incidence Angle, (variable) 0 to 10 degrees
Radius of Flap at wing tip.........8 feet
Weight per square foot.......1¼ pounds
Lifting surface of wings.......240 sq. ft.
Aera of tail...................30 sq. ft..
Engine..........................5 H. P.

Instead of using a propeller, flapping wings will be used, which is believed to be sufficient for "taking off." The engine will turn at 800 to 900 R. P. M., geared down to a crank turning at 30 r. p. m., to which the wings are attached.

Balancing in the air is to be accomplished by increasing the incidence of one wing while decreasing the angle on the opposite wing? Ascension to be made by increasing the angle of both wings, and descent by flattening the angle.

The Mechanical Properties of Metals

THE mechanical properties of metals may be most simply studied by considering the phases through which the



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material passes when continuously loaded, say, in tension, until rupture takes place. Mild steel may be taken as an example.

If a steel bar is subject to an increasing load it at first stretches almost imperceptibly; if during this period the load be removed, it returns to exactly its original length. Thus it acts practically as an exceedingly stiff spring. During this phase it obeys "Hook's Law," which states that stress is proportional to strain. This law is usually written f=Ed where f is the stress in pounds per square inch, d the strain expressed as a fraction of the original length, and E is the ratio termed the "Modulus of Elasticity."

Suppose that the load be continously increased. A point is necessarily reached when the law breaks down. This is called the Yield Point. Up to the yield point the material is elastic, and on removal of the load reverts to its original size. Loads occassioning stresses beyond the yield point, however, cause the materials to take a permanent set.

A stress termed the Ultimate Stress, considerably greater than the yield stress, has to be applied before the material ruptures. Elongation between yield point and fracture may be considerable, depending upon the nature of the material. Failure finally occurs owing to local contraction at the weakest section.

A material which stretches considerably between the elastic limit and the point of ultimate failure is said to be ductile. This property is of great importance. Although the stresses in material under normal working conditions are well below the elastic limit, when excessive stretches occur which are liable to cause failure, the effect of ductility is felt. A ductile material has to give considerably before failure, and in so doing may avert failure by throwing part of its load on to other members of the structure.

Where sudden loads are anticipated ductility is essential. Cast metals as a rule have little ductility. They fail immediately after the yield point is reached.

The effect of stressing materials beyond their elastic limit is of interest. It is usually to harden them, that is, to raise the yield stress and to reduce their ductility. This effect is made use of in the manufacture of wire and sheet. These are rolled down from billets, the material being annealed from time to time to soften it. If the finished sheet is not finally annealed it will be much harder than the original material.

Fine steel wires may have an ultimate strength of well over 100 tons per square inch. Aluminum sheet likewise may have a strength of 15 tons per square inch, though the same material annealed would only stand 6 or 7 tons per square inch. A copper pipe that is bent or hammered is affected in exactly the same way. The ductility of materials can usually be restored by means of suitable heat treatment —steels by annealing, copper by quenching.

The effect of heat on the mechanical properties of metals is exceedingly important, particularly in the case of alloy steels. As working and heat have so great an effect on the properties of materials, care must always be exercised in subjecting parts to either. If a special steel axle tube, for example, be brazed, its mechanical strength at the point heated may be reduced by half.

When materials are subjected to constantly alternating stresses they become "fatigued." Engine parts are particularly liable to fatigue. A constantly vibrating wire is another example. Alternating stresses much below the yield stress of the material cause a gradual crystallisation or coarsening of the structure of the material, which reduces its strength considerably and robs it entirely of its ductility. Provided that a sufficiently low stress is used, it appears that an indefinite number of alternations of stress are possible without ill effect.

Latest List of Model Aeroplane Records

Supplementing previous lists of model aeroplane flight records published in Aerial Age, the list below gives the most recent records, corrected to the date of September, 1922. The list has been compiled by the Illinois Model Aero Club of Chicago, Ill., whose members have held the majority of records for several years past.

Some of these records will no doubt stand unbeaten for some time, but in many cases they can be equalled by those having the patience and skill acquired by I. M. A. C. members. The records are being shattered one by one, for the I. M. A. C. members are not content to let the records stand for any length of time. This friendly rivalry evidenced in the spirit of this club is one of the principal factors promoting its growth which can well be adopted by the more recent model clubs.

The I. M. A. C. offers its assistance to all interested in the scientific sport of model flying, and further information is to records etc. is available to those who direct their inquiries to Mr. Warren H. DeLancey, Secretary of the I. M. A. C., Auditorium Hotel, Chicago, Illinois.

LIST OF WORLD'S RECORDS FOR RUBBER DRIVER MODEL AEROPLANES

Type of model	*Kind of contest*	*Record*	*Held by*
Twin Pusher, Hand Launched	Duration	265 Seconds	R. Jaros
Twin Pusher, Hand Launched	Distance	5337 Feet	Thomas Hall
Twin Pusher, R. O. G.	Duration	209 Seconds	R. Jaros
Twin Pusher, R. O. G.	Distance	4029 Feet	W. Schwietzer
Twin Pusher, Hydro	Duration	172 Seconds	B. Pond
Tractor, Hand Launched	Duration	240 Seconds	D. Lathrop
Tractor, Hand Launched	Distance	2465 Feet	B. Pond
Tractor, R. O. G.	Duration	227.4 Seconds	P. Breckenridge
Tractor, R. O. G.	Distance	2685 Feet	P. Breckenridge
Tractor, Hydro	Duration	116 Seconds	L. Hittle
Indoor, Hand Launched	Duration	170 Seconds	B. Pond
Scale Model	Duration	21 Seconds	R. Jaros

The Orenco Fighter Model.

The Orenco Fighter makes a very pretty model, especially if all details are used in the construction.

A model of this machine was built from plans published in the March 14, 1921 issue of Aerial Age, by A. I. Mead of Norwalk, Conn. More detail has to be gone into in order to achieve a realistic appearance for exhibition purposes. The model having movable rudder, stabilizer and ailerons? The rubber and stabilizer being adjusted by screws from beneath the cockpit and the ailerons in the same manner.

The radiator, dummy motor and the top of the fusalage are of balsa. They are all removable as are the wings.

The motor stick is attached to the radiator, then making it easy to remove and repair the rubber band motor, which is composed of twenty-five feet of one eighth (1/8) inch flat rubber, driving a ten inch, four blade propeller. The two-blade propeller is used for exhibition purposes only.

Though weighing exactly one pound, complete, the model has made flights of about one hundred and fifty feet at a high rate of speed.

Enlargement of Activities at Chanute Field.

Chanute Field, Rantoul, Ill., is a busy place nowadays. Since the arrival of the Communication School from Post Field, Fort Sill, Okla., and the Photographic School from Langley Field, Va., the already busy routine of the post has been considerably enlarged. The question of room to be alloted to these various schools for purposes of instruction is somewhat of a problem, but is being met by the erection of additional steel hangers. One hanger has already been completed, and three others have been contracted for. The erection of several hangers in addition to this number is contemplated in the near future.

Among the new officers reporting at Chanute Field for duty with the Photographic School are Captain W. C. Wheeler, Air Service, Commanding; and 1st. Lieutenants Robert Cronau, J. P. Hodges, Stewart W. Torney and E. B. Robzien.

The school detachment consists of 25 enlisted men. Wtih the exception of Capt. Wheeler, all of the above officers came by airplane, ferrying over photographic planes from Langley Field.

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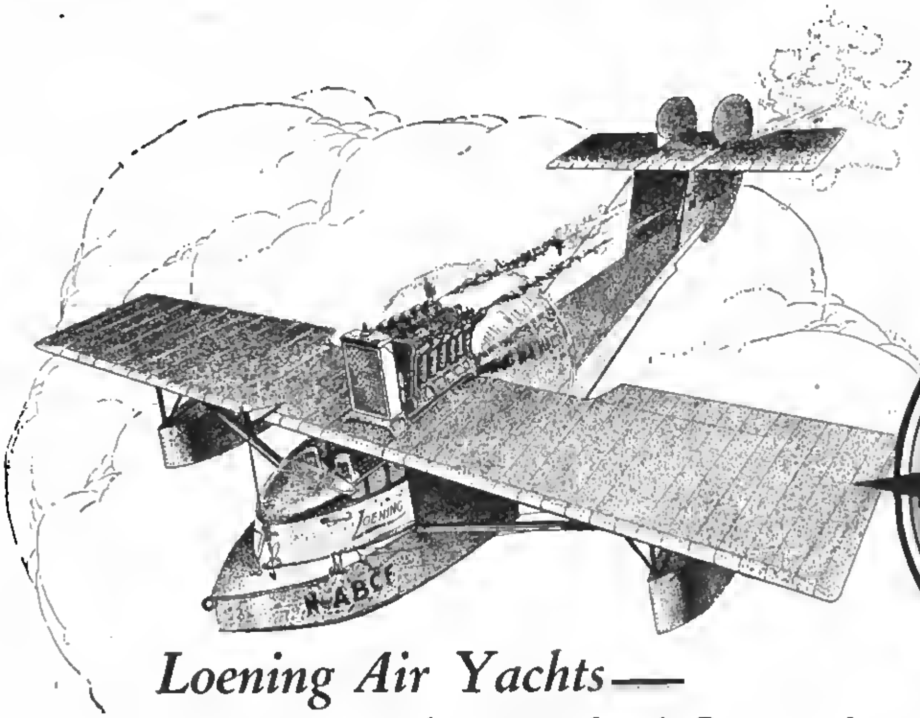
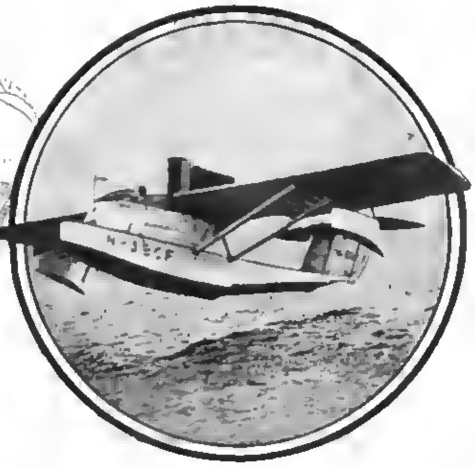


Photo below shows one of the air yachts—taking off from the water



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August 11th, 1922

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(*Continued from page* 498)

effort should be made to plan for the future even if the immediate equipment is very modest. Although the aircraft industry is moving very slowly at present, it is growing nevertheless. There is no doubt that the tightness of funds, which came as a result of the war, has had much to do with the slowness of this growth.

The condition of financial stringency is passing and money rates are rapidly returning to normal. With money rates back to normal, those somewhat speculatively inclined will become dissatisfied with the usual low interest rates on gilt-edge investments. Such people may be expected to cast around for new investment fields offering greater returns, even if somewhat speculative, and the operation of aircraft on a comprehensive scale is very sure to attract their attention. At the same time, it has already been demonstrated that aeroplane transportation can be made to pay even on a comparatively small scale when properly managed. As the scale of operation is increased, with growing traffic, the revenue will increase very rapidly.

Considering all of this, it is by no means unlikely that the much-looked-for recovery of the industry will comes suddenly when it does come.

A New School Group in the Air Service.

Orders have been issued creating a new group in the organizations of the Air Service, to be known as the 10th Group (School), to be located at Kelly Field, San Antonio, Texas, and to consist of the following organizations:

- 39th Squadron (School) Pursuit
- 40th Squadron (School) Bombardment.
- 41st Squadron (School) Attack
- 42nd Squadron (School) Observation
- 43rd Squadron (School) Service
- 13th Air Park
- 22nd Photo Section
- 10th Group Headquarters Detachment.

Major John N. Reynolds, Air Service, will be in command of this new Group, which is to form the Advanced Training School of the Air Service. In its organization, it is contemplated that each of the present tactical groups of the Air Service shall furnish the nucleus of the new squadron which is to carry on its specialized work in the school. With this in view, the 2nd Group (Bombardment), which has been transferred to Langley Field, Va., has left some 14 officers and 100 enlisted ment at Kelly Field to form the nucleus of the 40th Squadron. The 1st Group (Pursuit), formerly at Ellington Field and lately transferred to Selfridge Field, Mt. Clemens, Mich., is transferring some 10 officers and 100 enlisted men to form the nucleus of the new 39th Squadron. The 3rd Group (Attack), Kelly Field, will furnish the nucleus of the 41st Squadron. Seventeen officers and 350 enlisted men are being transferred from Post Field, Fort Sill, Okla., to form the nucleus of the new 42nd Squadron, the 13th Air Park and the 22nd Photo Section. About 100 enlisted men are being transferred from the Lighter-than-Air branch (Brooks Field) to form the nucleus of the 43rd Squadron.

When the school group is completed, it is contemplated that the four different courses, which are now being given at three different stations, will be coordinated and fitted together in order that they may be given at one station. Pilots who graduate from this school will have good general knowledge of all tactical branches of the Air Service, as well as a very thorough knowledge of their own special branch.

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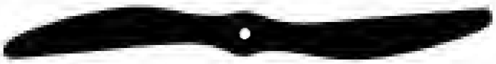

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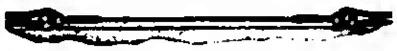

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Grade A Mercerized cotton 55c. yd; cotton tape 6c. yd; Grade AA linen (beautiful goods) 80c. yd.; linen tape 8c. yd.; Canuck or JN4D Upper cotton wing covers $15.00; Canuck lower cotton or linen wing cover $12.00; Splendid Guaranteed nitrate dope $2.00 gal., or 5 gals. $9,25; Champion Spark plugs 75c.; wing skids, windshields, cable, new OX5, OXX6, 150 H. P. Hispano and 190 H. P. Mercedes Motors, and everything.

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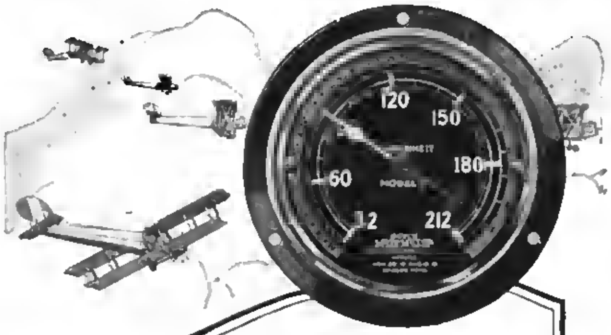

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AIRCRAFT YEAR BOOK

Edition of 1922

Published by Aeronautical Chamber of Commerce of America, Inc.

250 Pages Text; 40 Pages Illustrations; 40 Pages Aircraft and Engine Drawings

TABLE OF CONTENTS

CHAPTER

I Review of Commercial Aviation During the Year—Aircraft Demonstrate Practical Utility—Significance of Aircraft Battleship Demonstrations—Air Law in Sight—Aeronautical Chamber of Commerce Organized...........

II Problems of Aerial Transportation—Capital, Terminals, Reliability—Needs Which Can be Met Through Aerial Law—Report to Secretary of Commerce on Safety in Flight.......

III The Air Demonstrates Its Command of the Sea—The Battleship Bombing and Conference on the Limitation of Armaments...........

IV Review of Aeronautics Throughout the World, Nation by Nation..................

V Technical Progress in Aircraft Construction During the Year.........................

VI Airships in Commerce.....................

HISTORICAL DESIGN SECTION...............

APPENDIX

Commercial Section: Aeronautical Chamber of Commerce of America, Inc.; Manufacturers Aircraft Association, Inc.

U. S. Air Service, War Department: Organization; Officers on Duty in Washington; Army Corps Areas and Departments; Stations and Activities.

Bureau of Aeronautics, Navy Department: Organization; Officers on Duty in Washington; Officers with the Fleets; Naval Air Stations.

Marine Corps, Navy Department: Organization; Officers; Aviation Stations.

Strength of U. S. Air Forces (Army, Navy, Marine Corps); Diplomatic Service of the U. S.; Air Attaches, War Department; Air Attaches, Navy Department; Diplomatic Service to the U. S.: Foreign Air Attaches; Aeronautical Board; Personnel and Committees; Helium Board; Board of Surveys and Maps, Department of Interior.

Aircraft Appropriations, Foreign; Aircraft Appropriations, U. S.; Military; Naval; Postal; Aircraft Production Cost, 1917-1918; Foreign Subsidies for Civilian Aviation; Armament Conference Report on Aircraft.

Air Mail Service, Post Office Department: Executives; Air Mail Fields; Transcontinental Controls; Planes in Service; Consolidated Statement of Performances, May 15, 1918—Dec. 31, 1921; Forest Fire Patrol, Department of Agriculture; National Advisory Committee for Aeronautics; Organization; Summary of Report; President's Letter of Transmittal; Customs Regulations, Treasury Department; Public Health Service, Treasury Department; Aircraft Imports and Exports; Bureau of Standards, Department of Commerce; Bureau of Foreign and Domestic Commerce, Automotive Division, Department of Commerce; Air Law Section: Wadsworth Bill, creating Bureau of Civilian Aeronautics in Department of Commerce; Fake Stock Warning, National Vigilance Committee; Associated Advertising Clubs of the World; Aircraft Insurance; National Aircraft Underwriters Association; Colleges and Schools Offering Courses in Aeronautics; Landing Fields and Air Terminals; Chronology for 1921; Remarkable Aeronautical Performances, 1920; World's Records, 1921; Trade Index.

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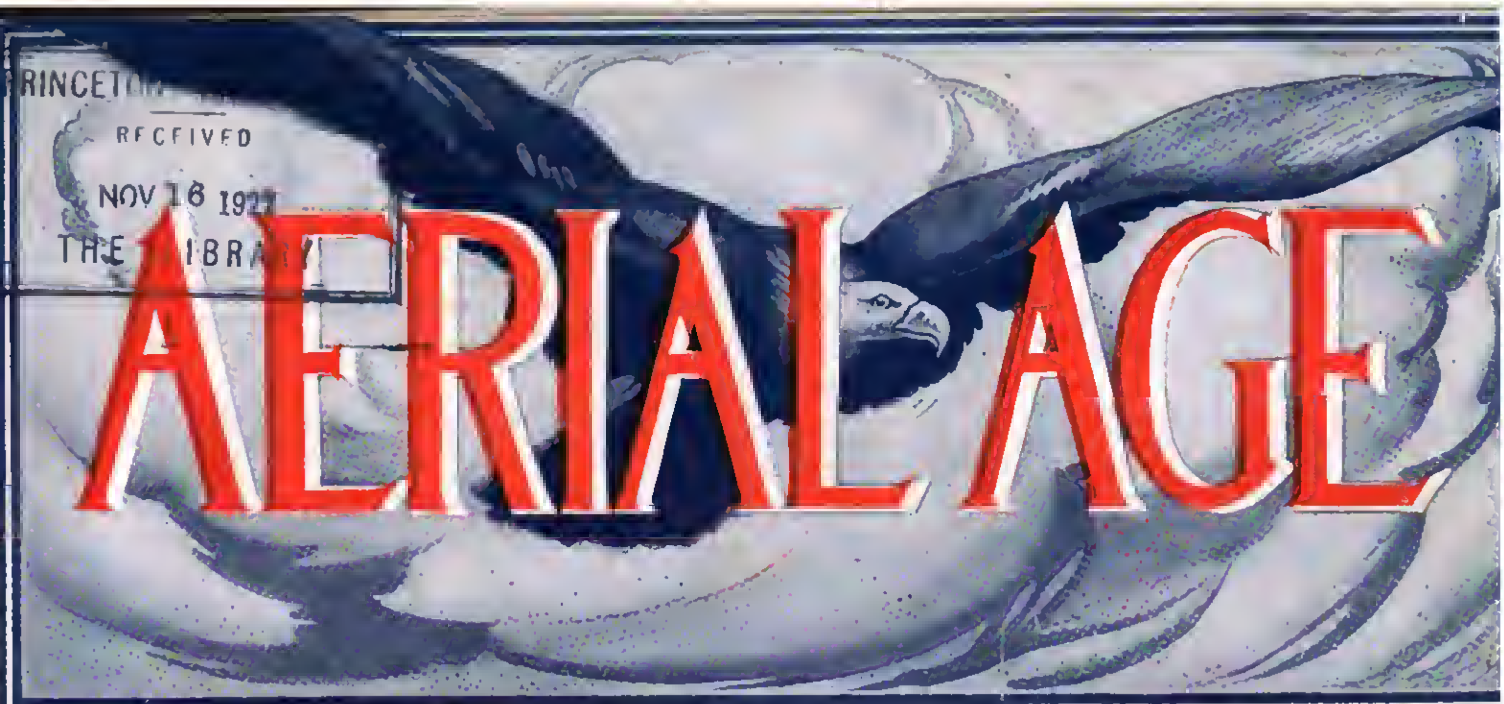

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World Records Established At Detroit

How the Fastest Aeroplane in the World Was Built

Silencing Aircraft

Flying In California

TORPEDO PLANES HIT THE ATLANTIC FLEET!

A DEMONSTRATION OF THE IMPORTANT PART AERONAUTICS WILL PLAY IN FUTURE NAVAL WARFARE

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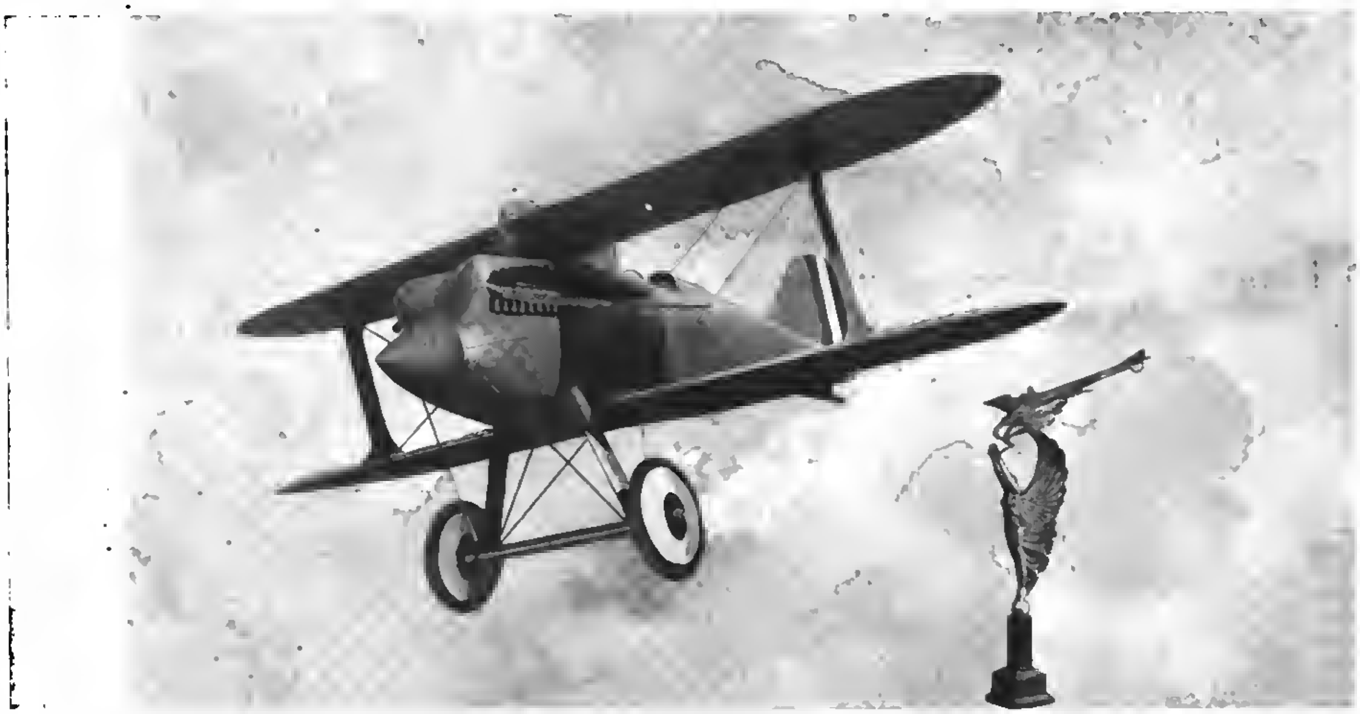


CURTISS *FIRST* *again!*

Lieutenant R. L. Maughan, U. S. A., won the Pulitzer Trophy in the Army-
Curtiss Racer No. 2—Average speed 205.8 m. p. h., for the 160 mile course.

SECOND

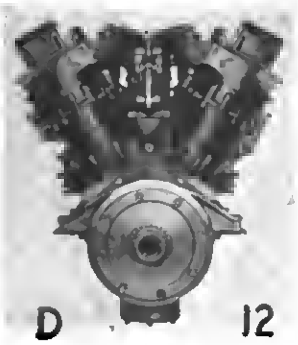
Lieutenant L. J. Maitland wins second place in the Army-Curtiss Racer No.
1, speed for the entire course at the rate of 198.8 m. p. h.

THIRD

The Navy wins again. This time the Navy-Curtiss Racer No. 1 (which won the Trophy Race last year) piloted by Lieutenant H. J. Brow, U. S. N., came third, at a speed of 193.8 miles an hour.

FOURTH

Ensign A. J. Williams, pilot, U. S. N., flying the Navy-Curtiss Racer No. 2, finished fourth in the race at a speed of 188 m.p.h., 7 miles an hour faster than his nearest competitor.



The Curtiss D-Twelve 375 H. P. engine with which the two Army-Curtiss Racers are powered.

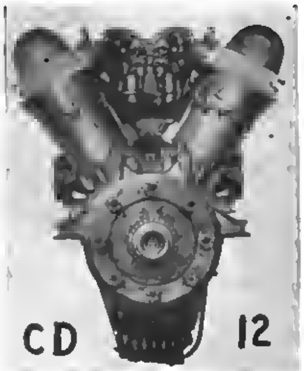
100 PER CENT PERFORMANCE

Four Curtiss Racers were entered in the Detroit event——All four completed the flight without mishap and each one beat the existing world's speed record.

And now the United States holds the officially recognized international speed record, made by Brig. General William Mitchell on October 17th in an Army-Curtiss Racer—

SPEED 224.05 MILES AN HOUR

Curtiss



The Curtiss CD-Twelve 375 H. P. engine, used in both Navy-Curtiss Racing Aeroplanes.

THE CURTISS AEROPLANE AND MOTOR CORPORATION
GARDEN CITY, NEW YORK

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World Records Established in Pulitzer Race

INTERNATIONAL aeronautic history was written at Detroit on October 14, when the year's aeronautic classic, the Pulitzer Race, was staged. The world's speed record was shattered by a good margin, and the Curtiss organization established a very unique record in having its ships take first, second, third and fourth place.

Having in mind the extraordinary speed attained by the contestants, another remarkable feature of the race was the entire lack of accidents. Several of the machines dropped out of the race, but no injuries were sustained by any of the pilots.

The order in which the pilots finished was as follows:

Lieut. Russell L. Maughan, army Curtiss racer, CD-12, 206.

Lieut. Lester J. Maitland, army Curtiss racer, CD-12, 203.

Lieut. Harold J. Brown, navy Curtiss racer, D-12, 193.2.

Lieut. Alfred J. Williams Jr., navy Curtiss racer D-12, 188.

Lieut. Eugene H. Barksdall, Sperry pursuit, Wright, 181.

Lieut. Fonda B. Johnson, Sperry pursuit, Wright, 178.

Capt. Corliss C. Moseley, Verville pursuit, Packard, 177.3.

Lieut. Eugene C. Whitehead, Loening pursuit, Packard, 170.2.

Lieut. La Clair D. Schulze, Loening pursuit, Packard, 160.9.

Capt. Clayton L. Bissell, Morse pursuit, Packard, 155.5.

Capt. Frank O. D. Hunter, Morse pursuit, Packard, 149.3.

The complete list of entries in the Pulitzer race was as follows:

Marine Corps: Capt. Francis P. Mulcahy, Thomas-Morse MB-7, Wright 400 horse-power.

Lieut. Lawson H. Sanderson, Chance Vought (mystery ship), Wright 400 horse-power.

Navy: Lieut. David Rittenhouse, Booth BR-W, Wright 400 horse-power.

Lieut. Stephen W. Callaway, Booth BR-1, Wright 400 horse-power.

Lieut. Alfred J. Williams Jr., Curtiss No. 1, Curtiss 400 horse-power.

Lieut. Harold J. Brown, Curtiss No. 2, Curtiss 400 horse-power.

Army: Lieut. Corliss C. Moseley, Verville HSP, Packard 600 horse-power.

Lieut. R. L. Maughan, Curtiss HSP, Curtiss 375 horse-power.

Lieut. Leslie J. Maitland, Curtiss HSP, Curtiss 375 horse-power.

Lieut. E. C. Whitehead, Loening HSP, Packard 600 horse-power.

Lieut. L. A. C. D. Schulze, Loening HSP, Packard 600 horse-power.

Capt. Frank O. D. Hunter, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. Clayton L. Bissell, Thomas-Morse HSP, Packard 600 horse-power.

Lieut. E. H. Barksdale, Sperry HSP, Wright 350 horse-power.

Capt. St. Clair Street, Sperry HSP, Wright 350 horse-power.

Lieut. Fonda B. Johnson, Sperry HSP, Wright 350 horse-power.

Capt. Albert M. Guidera, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Benjamin R. McBride. Thomas-Morse MB-3 Wright 300 horse-power.

Capt. H. M. Elmendorf, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. Donald F. Stace, Thomas-Morse MB-3, Wright 300 horse-power.

Capt. Oliver W. Broberg, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. James D. Summers, Thomas-Morse MB-3 Wright 300 horse-power.

Lieut. Thomas K. Matthews, Thomas-Morse MB-3, Wright 300 horse-power.

Lieut. George P. Tourtellot, Thomas-Morse MB-3, Wright 300 horsepower.

The abbreviation HSP, means high speed pursuit.

The story of the race by Frederick Pasley, staff correspondent of the New York World gives an excellent impression of the spirit of the race.

It was a race without a spill. There were four forced landings but all planes were brought down under control. Contrary to the expectations of the thousands who journeyed to Selfridge Field, every pilot who went up came down safely.

It was a personal triumph for Glenn H. Curtiss. He is established beyond cavil as the world's foremost aeronautical engineer. His judgment on wing radiation and stream lining has been completely vindicated.

So certain were army officials of what his ships would do that they withdrew the eight Thomas-Morse MB-3 planes a few hours before the race. They were flown early in the day for the Mitchell Trophy, donated by Brig. Gen. William Mitchell in memory of his brother, who was killed in France.

Of the other Pulitzer entrants Lieut. David Rittenhouse, navy pilot of the Booth racer, withdrew because of engine trouble before taking the air.

The Army-Curtiss Racer, winner of the Pulitzer trophy, and its pilot Lieut. R. L. Maughan

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The TR-1 Naval Seaplane, winner of the Curtiss Marine Flying trophy, equipped with Lawrance radial engine piloted by Lt. A. W. Gorton

Capt. Francis B. Mulcahy of the United States Marine Corps, piloting the Thomas-Morse MB-7 overhead wing monoplane, was forced out after completing two laps because of overheated oil in the lubricating system. He was averaging about 140 miles an hour.

Lieut. Lawson H. Sanderson, in the widely heralded navy mystery ship with the Wright 600 horsepower engine, had to land in a golf course when similar trouble developed on the fourth lap. He was averaging around 186 miles an hour.

Lieut. Stephen W. Callaway, also of the navy, piloting Booth Racer No. 2, had to take the ground at the beginning of the second lap because of a broken oil lead. He had made the first lap in 163 miles an hour.

Capt. St. Clair Street completed four laps in his Sperry high speed pursuit, powered with a 350 horsepower Wright motor, and then bugs developed and he had to land in a a golf course a half mile back of the Grand Island. He brought his plane down safely. He was averaging 165 miles an hour.

Two Navy Craft Finish

The only ships that finished for the navy were the Curtiss racers. piloted by Lieut. Albert J. Williams Jr. and Lieut. Harold J. Brow. Each flew a good race. Brow in particular handled his ship at the pylons with a craftsmanship almost equal to that of Maughan.

Brow's time for the race was 193.2 miles an hour. Williams's time was 188. Brow's ship has wing radiation. Williams carried two Lamblin radiators, open mesh ovals that look something like wire waste baskets. The resistance of the Lamblin is said to have decreased Williams's speed by fifteen miles an hour.

Hangar gossip had had Maughan a winner weeks ago. Maitiand is a skilled pilot. He is at home in any kind of a ship. But Maughan belongs to that rare species—a birdman to the manner born. There are few like him. Hunter is said to be his nearest approximation at Selfridge Field.

After the race had started and a line had been gained on the other entrants, particularly the freak machines of which so much had been whispered, it was apparent that Maughan and Maitland would battle it out.

216-Mile Speed on One Lap

And at the end of the first lap, when the judges announced that Maitland had made the circuit at 216 miles an hour, the grand stand and press box were in a turmoil. They couldn't believe it. The judges, however, insisted that was his time.

In any event it changed the complexion of the race. Maughan's average for the first lap had been but 206. Then Maitland's average for the second lap was announced—200. Maughan crossed the timers' wires the second time, averaging another 206.

Maitland on his third lap slipped back to an average of 197 miles an hour. Maughan was timed at 207. It was apparent that an error had occurred in the computation of Maitland's first lap, or that he had unconsciously lost his way and skipped a pylon at either Gaulkers Point or the United States cruiser Dubuque. But no rectification was made.

Maughan's average for the fourth lap was 205 miles and for the fifth and final 206. Maitland averaged 203 for the fourth and 200 for the fifth.

Maughan was the first to land.

The Curtiss Marine Trophy Race

The Curtiss marine trophy race was flown October 8 under lowering skies and in a boisterous air. Eight naval seaplanes started in the 160-mile flight and two finished. The winner, piloted by Lieutenant A. W. Gorton, United States Navy, was the T R-1 ship-plane. It covered the course of eight twenty-mile laps with three landings at an average of 112.65 miles an hour.

The second ship to finish was the Standard Vought observation seaplane, driven by Lieutenant H. A. Elliot, who attained 109 miles an hour.

In the course of the race, six contestants were forced out, one because of engine failure, one from loss of radiator water, two from propeller trouble, one from exhaustion of gasoline and one from a broken wing tip pontoon.

Lieutenant Gorton, the winner, flew a perfect race. His water work was especially good, as he slid into the water controls at the end of the fifth, sixth and seventh laps without shock or "porpoising."

Gorton belongs to Pawtucket, R. I., is a war veteran and participated in the second battle of Verdun as a member of the Ambulance Corps of

The Thomas-Morse Army Racer

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The Verville-Sperry R3 Army Racer, equipped with 400 H. P. Wright engine

the French army. He transferred from the French army in 1917 to naval aviation. He has had more than 1,200 hours in the air.

The T R-1, which carried off the honors of the day was designed by Commander J. C. Hunsaker, of the Bureau of Aeronautics, United States Navy, and built at the naval aircraft factory in Philadelphia. It is powered with a twenty horsepower Lawrence Radial air-cooled engine, a new development in American engineering practice.

Liberty Engine Builder's Trophy

Lieutenant T. J. Koenig, in a Detroit-built plane, equipped with a Detroit-made motor, won the race for the Liberty engine builders' trophy October 13 over the 2?0-mile triangular course, with an average speed of 128.8 miles an hour.

The plane, a Lepere observation, was built by the Packard Motor Car Company, as was its engine, Liberty 12, 400 horsepower. It is the same plane in which Lieutenant C. J. MacReady established the world's altitude record of 37,000 feet last year.

Lieutenant Koenig varied not more than two miles an hour in any lap from his average speed for the ten laps. The first three laps he made at 130 miles an hour, the next five at 129 miles, the next five at 128 miles, and the last lap at 129 miles an hour. On the last leg of his last lap, while he was over Lake St. Clair, his air pressure feed, which forced gasoline to the carburetor from the tanks went wrong and he was compelled to resort to an emergency gas tank for fuel.

Second place in the race went to Major Follett Bradley in a De Haviland 4-B observation plane. He averaged 126.4 miles an hour for the ten laps. Major Bradley is a graduate of Annapolis.

Lieutenant W. L. Boyd, also piloting a De Haviland 4-B observation plane won third place. He flew a perfect race, averaging 122 miles an hour in every one of the ten laps. Army men said this was a remarkable achievement.

Only six of the nine starters in the race finished. Fourth place went to Lieutenant W. R. Carter, in a De Haviland 4-B observation plane, with an average speed of 118.1 miles an hour; fifth place, to Lieutenant J. D. Givens in another De Haviland, averaging 114.1 miles an hour, and sixth place, to Lieutenant B. R. Morton, also in a De Haviland, who averaged 112.8 miles an hour. Lieutenant Givens made the most spectacular race, his turns being hair-raising.

Detroit News Contest

Piloting a Martin transport, driven by two 400-horsepower Liberty motors, Lieutenant Eric H. Nelson of Montclair, N. J., won the Detroit News aerial mail trophy race for multi-motored planes October 12. He covered the 240-mile triangular course at an average speed of 105.1 miles an hour.

The Detroit Aviation Country Club trophy race, flown over the same course, was won by Lieutenant Harold H. Harris, one of the two army entrants, in the "Honeymoon Express," equipped with a 400-horsepower Liberty 12 motor. Lieutenant Harris averaged 135 miles an hour in this event, which was for light commercial planes, finishing four laps ahead of C. S. Jones, in a Curtiss Oriole, who averaged 110 miles an hour.

A stiff northwest wind blowing at the tail of the big planes in The Detroit News event made necessary abandonment of the original plan of starting all of the craft together. Consequently the planes, each weighing five tons and having a wing spread of seventy feet, took the air one after the other, Lieutenant Nelson's plane being the last to cross the starting line. The transport began at once to overhaul the other racers, and before the race was three-fourths over it was seen that unless forced down, Lieutenant Nelson would win.

All but one plane of the nine entered in the two events finished. James M. Johnson, in a Vought V. L.-7, was forced down in the fourth lap when dirt fouled his carburetor. He landed near the Mount Clemens Golf Club and ran into a ditch, damaging his landing gear and both wings. Neither Johnson or his two passengers were injured.

Lieutenant Nelson, who, when he alighted from his plane at the finish, was warmly congratulated by Major Gen. Mason M. Patrick, Chief of the Army Air Service, carried three army privates during the flight. Both Lieutenant Nelson and Lieutenant Harris ascribed their victories to the "good planes" they piloted.

The 18T Curtiss Triplane, equipped with CD-12 Curtiss Engine, which won the prize for speed in Curtiss Marine Trophy Race

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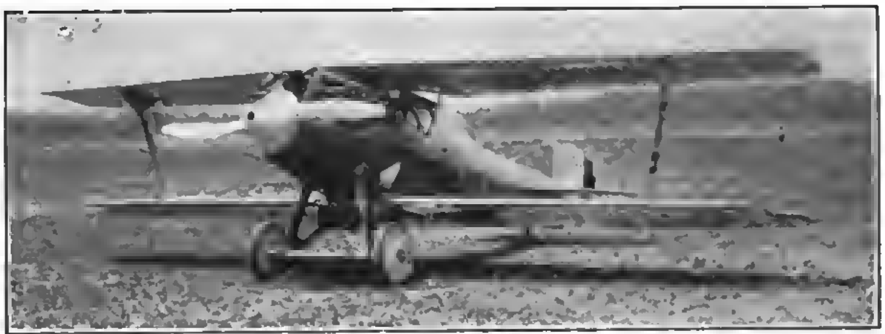
Lieutenant Nelson was one of the pilots in the army's New York-Alaska flying expedition in 1920. Lieutenant Harris is a McCook Field, Dayton, Ohio, pilot.

Twelve hundred dollars was awarded winners of the two races, in addition to the trophies. Prizes of $600 and $200 were awarded, respectively, to second and third places in both events.



Venville C. P. Racer, equipped with 600 H. P. Packard Engine

Across the Continent in Twenty-two Hours

Doolittle's Transcontinental DH4B Alterations—Other Transcontinental Flights

Lieut. Doolittle's Wonderful Feat

SEPTEMBER 5th, was a red letter day in the history of aviation in this country for it marked the successful culmination of a remarkable airplane flight across the United States from the Atlantic to the Pacific Coast within the elapsed time of 24 hours, the first time such a feat has ever been accomplished.

A young Army aviator, tired and exhausted from the strain of his long flight, his eyes heavy for lack of sleep, but happy in the thought that he had accomplished his cherished ambition, hopped out of his plane at Rockwell Field to greet his admiring comrades in the service who had gathered to meet him. This pilot, with a string of aviation achievements to his credit that belies his name, Lieutenant James H. Doolittle, broke all previous existing records for a flight across the continent, his actual flying time being 21 hours and 20 minutes, and his elapsed time 22 hours and 35 minutes, a stop of an hour and fifteen minutes being made at Kelly Field to replenish his fuel supply.

Following Aerial Age prints a detailed list of all the changes made in the DH4B used by Lieut. Doolittle in his record one-stop transcontinental flight. A new main gas tank of 240 gallons was installed immediately back of the engine, necessitating the moving back of the pilot's cockpit, changes in location of struts, control and brace wires and a number of others, including a lift wing on the axle.

a. The two vertical fuselage struts at station ten were moved back about 4" to a point directly over the spreader bar between the rear spars of the two lower wings and the fuselage brace wires in back of the engine were moved forward two and three-quarters inches at the top in order to accommodate the two hundred and forty gallon main gas tank. Normally the tank is of 88 gallon capacity. The controls and front pilot's cockpit were moved back sixteen inches for a similar reason and the aileron control was turned around so that the arc was in back of the pilot's seat. This was in order to allow the main gas tank to be as deep as possible and necesitated an extra set of pulleys in the aileron controls.

b. The cross brace wires under the tank were removed and 1-⅛" laminated wood braces put in, in front of and in back of main tank to take the strain. That left a 1-⅛ by 3 in. laminated wood brace between the landing gear fittings instead of the standard 1" by 3" spruce compression members.

c, The Year or observer's cockpit was boxed in with 3/16" 3-ply veneer adding great strength to this inherently weak part.

d. A ¾ x 1-¼" ash brace was placed under the top longerons for a distance of eight feet to prevent bowing and to add strength.

e. Six vertical compression members were added between station ten and the engine to transmit the weight of the gasoline tank from top longeron to bottom.

f. The tail skid post, axle and shock absorber bars were reinforced by having an extra seamless steel tube driven into them their entire length.

g. Old style DH-4A ash landing gear was used for strength and also because it is four inches higher and would so raise the lower wings into a more efficient position and give more clearance for the

h. A wing 17" x 48" was built on the landing gear fairing and set at an angle
Martin propeller.
of incidence one-half of a degree less than that of the wings.

i. The tank cowl was raised 1-¾ inches to allow for the higher gas tank and also to give a slight camber to the top of the

Lieut. James H. Doolittle

fuselage. An effort was made to concentrate the weight of gasolin as near the center of lift of the ship as possible, in order that the pilot could sit forward where he had better control and also so that the balance of the ship might be maintained at all times. This was realized and the oil tank forward so well balanced the large gas tank that it was not necessary to touch the stabilizer at any time between full load and empty.

j. The main gravity full tank held thirty gallons and was placed between the spars in the center section. There was a 1-½ gallon expansion tank for water in the leading edge of the center section. The oil tank held 24 gallons and was placed under the motor and held in place by three straps running to the upper longerons.

k. The syphon system of gasoline feed was used and found to be most satisfactory.

l. The main gas tank was notched out for a distance of nine inches to allow it to set down over the spreader bar between the front spars of the lower wings. A 1-¾" hole in the tank allowed room for a rod to tie the longerons together.

m. The bottom of the fuselage was dropped and lowered so that it made a perfect streamline from radiator cowling to tail.

n. The wings were of selected spruce, care being exercised to pick out the lightest possible frames. The extra ribs in the inner bay were spliced and ran out to the trailing edge. An extra rib was placed in between each rib in the outer bay and the ailerons each had an extra rib between each regular rib. The fabric was sewed on with a 1-½" stitch instead of a 3" stitch. The wings were given four coats of dope, two of pigmented dope and one of varnish. All of this added about ten pounds to each wing but greatly strengthened them and the extra ribs allowed the wing panels to retain their original shape and this increased their efficiency.

o. The "ship" had an excellent performance. Took off in about three hundred and fifty yards full. Climbed seven thousand feet in fifteen minutes at 1550 R.P.M., and flew about 100 M.P.H. full and 105 M.P.H. nearly empty at 1480 R.P.M.

(*Concluded on page* 561)

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How the Fastest Aeroplane in the World Was Built

THE victory of the Army-Curtiss racer, which flew faster than any machine has ever travelled before, is no more remarkable than the speed with which the aeroplane was built. The design had been submitted to the Navy Department as representing a year's improvement on the Curtiss-Navy racer which won the the Pulitzer Trophy race of 1921. But the Navy seemed reluctant to order a plane built by the same company to compete against the fastest plane existing in the service.

Believing in the unparalleled efficiency of this design, private interests were sought to sponsor its entry in the race. The time for the race was drawing near and there seemed no chance of demonstrating its true worth. Then came a request from the Army for a pursuit design embodying just such features as possessed by this ship, bringing it to the favorable attention of Air Service officials. Arrangement was soon made for the construction of two test ships to fulfill the apparently daring predictions made for their performance.

A year's time is usually allowed for the building of any new type of aeroplane; this was an unusual design and under ordinary conditions the time would have been too short. But instead of extending the period of construction, a new condition arose which completely upset existing ideas on time limits and customary routine procedure in the matter of aeroplane building—the Air Service wanted those two ships built in less than 90 days. Contracts previously let to other companies for racing planes called for delivery in time for the Pulitzer Trophy race, the speed classic of the year, which brings out the best speed possible in each of the ships entered. Could Curtiss build the ships in time to compete against the others?

Under ordinary conditions, the answer would be in the negative. It would be impossible. Government aeroplanes of various types were in production at the Curtiss Plant—large bombing planes were moving along through their various processes of production with clockwork regularity. No, it would never do to risk holding up any part of the work already under way, and there was no part of the factory which could be set apart for the purpose. But the Government wanted those new ships at once, for the design showed a ship capable of outclassing the best of them and therefore *must* be built in time for the race.

A consultation by the officials, engineers and heads of departments brought to light several interesting points which gave a promising aspect to the situation. The employees in every department united to carry through the decision arrived at; the work could be done, for the men were willing to sacrifice themselves to do it. It was a real test of their skill and of loyalty to their government. The question was settled then and there that the Army would get the ships in time.

The workers volunteered to give up their recreation building where noonday and weekly dances were held. The building was quickly transformed overnight into a factory complete in itself—all the necessary wood-working and metal machinery was installed so that work on the racers could proceed with no effect on the other work in the main shops.

While the equipment was being put in readiness, other work was proceeding in the Engineering branch, where the design goes through some very essential processes before reaching the shop. In the Mathematical and Design Analysis Departments, calculations are made of the structure as a whole and of the important units which comprise the machine. Determinations are made of the proper materials to use and the sizes required for safety. In the Research Department, investigatons are made of the theories and assumptions upon which the calculations are based, and tests made to verify the correctness of the design by means of "wind-tunnel" experiments.

An important feature of the wind-tunnel work is the testing of accurate models, made in the Model Shop. These models are exact miniature reproductions of the aeroplanes to be tested. So necessary is accuracy in these models, that in true scale they do not depart from the figured dimensions more than 1-4000 of an inch. The slightest inaccuracy in constructing them would render the tests worthless. In the wind-tunnel, the model is suspended in an artificial air stream which simulates the conditions existing in flight. By means of indicators and scales, it is possible to determine immediately the performance and degree of stability which can be expected in the finished aeroplane. In this connection, it is interesting to note that wind-tunnel tests showed the Curtiss-Army racer to be capable of a speed of 219.8 miles an hour, whereas on its first flight, the official timing of its actual speed showed it to be 219.5 miles; this varies less than one-quarter of 1 per cent. from the predicted performance for speed. The balance of the finished machine checked up perfectly with the preliminary recommendations of the Research Department.

Materials were tested in the chemical laboratory, where formulas for special steels and compositions are originated. Careful tests are made of many materials entering into the construction of the aeroplane so they may be selected to give the best possible service.

In the Physical Laboratory, wing ribs and tail units, etc., of the proposed design were built up and loaded with weights to represent the stress imposed during flight. Determination is made of the breaking point of each part so that weak places can be strengthened and parts proving too strong for the work required of them can be lightened. In this way, before the actual machine is built, there is no question about uniform strength throughout, no uncertainty about the reliability of the materials used and no doubt about its performance.

As parts were tested and found satisfactory, drawings for their construction were released to the shop. Shop foreman and many of the men skilled at special jobs were at work in stretches of from twelve to sixteen hours daily.

The wing radiators were a problem at first. Radiators of this principle had proven their worth in other Curtiss aeroplanes tested in the months preceding their adoption for the racing design. But complete wings such as these had never been built before, and the fact that they proved successful in a high-speed racer reflects great credit to the engineers responsible for them and the men whose patient work made it possible to complete them without mishap. The wing-radiator was adopted only after considerable research work was carried out to ascertain its advantages over the conventional forms of radiators. The idea was patented by the Curtiss Company some years ago and might have been used in connection with the Gordon Bennett Racer of 1920, but having no absolute data on their value, it was considered best to experiment with them until they became perfected before depending upon them for racing purposes.

Wing radiators of different forms and materials were applied to some of the Curtiss "Oriole" aeroplanes, where their efficiency was soon established. An Oriole plane with such a radiator was flown from New York to Kansas City, Missouri, a distance of about 1500 miles, at a speed averaging 100 miles an hour.

For many years it has been the aim of aeronautic engineers to reduce the head-resistance of radiators, and to do away with this resistance entirely is an advancement worthy of note. With wing radiators, the usual resistance of ordinary radiators is eliminated, which in turn adds to the speed of the aeroplane. In place of the automobile type of radiator, the engine water is cooled by circulating through narrow cells formed by corrugations of thin sheet brass with which the wings are covered. The surface friction of the air flowing past the wings must exist anyway and the wing radiator puts this air contact to good purpose. It has been established that this form of radiator has added not less than 12 miles an hour to the speed of the Racer. As to their reliability of functioning, after the first trial flights the pilot found nothing that required altering and further flight tests were continued with no adjustment necessary to any part of the system.

In connection with the water cooling system an original oil temperature regulating system is provided. It is well known that water heats up quickly as it circulates through the engine; also, the lubricating oil is slow to heat up, being so heavy. An ingenious method of locating an oil radiator in the water cooling system insures not only that the oil will be warmed up quickly, but also that its temperature will be kept uniform once it reaches the same temperature as the water in the radiator.

It is not possible to attribute the success of the Army Curtiss racer to any feature of its construction, for so many improvements exist throughout the design. A good share of its success, however, is due to the men in the various departments of the Curtiss plant—Executive, Engineering, Mathematical, Research, Chemical and Physical Laboratories, Designing, Drafting, Experimental, Model, Woodworking, Metal Working, Welding, Radiator, Sheet Metal, Covering, Doping and Painting, Heat Treating, Sand-blastin· Plating, Wire, Propeller Department, the Motor Factory, and Motor Testing Laboratory, Machine Shop, Inspection Department, all combined in one purpose—to build the fastest aeroplane in the world.

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1921 Curtiss-Navy Racer Speed Increased 16 Miles

THE Curtiss-Navy racer in the Pulitzer Trophy Race of last year, proved to be the fastest plane entered. Its winning speed was 177 miles an hour.

The Navy Department, wishing to enter this machine again in the 1922 race, gave the Curtiss company the opportunity of improving it in an effort to increase its speed. A year's progress in aeronautics made it possible to incorporate changes which reduced resistance and increased the lift to such an extent that a gain of 15 miles an hour was made in its speed. In an entirely new ship the increase would not have been so remarkable, but in this case the plane used in the experiment is the identical ship which won the race last year.

At slow speed, the resistance of an aeroplane is correspondingly low and irregularities in outline as well as blunt surfaces presented to the air are not of great moment. But as speed increases, resistance increases not in direct proportion but in a ratio of the "square of the speed"; in other words, if a wire, strut or other portion of an aeroplane has a resistance to the air of, say, five pounds when the machine travels at 100 miles an hour, at 200 miles an hour the resistance would not be ten pounds, as might seem natural, but would be four times that force, or twenty pounds.

At high speed, the retarding force of the air becomes the factor which limits the maximum velocity obtainable in an aeroplane.

The two French "Lamblin" radiators used before were the most efficient known, as their resistance to the air was the lowest by comparison with existing forms of radiators of the required capacity. Even so, their resistance at 180 miles an hour was about 50 pounds. By replacing the Lamblins with wing radiators, this resistance was entirely eliminated and still adequate cooling was retained.

In the wing-radiator, the water for cooling the engine circulates between double sheets of corrugated brass which cover the wing surfaces. The metal wing surface therefore dissipates the heat of the water by transferring it to the air, and thus the water is cooled without any additional apparatus exposed to the air. Before adopting this radiation principle, it was tested in all kinds of flight conditions during a period covering several months. During this time, sample radiators were installed on some of the Curtiss commercial planes, and cross-country flights, one of over 1500 miles, were made without mishap. Improvements brought about by the experience gained from actual use made possible their adoption for the racer with certainty about their efficiency.

A new wing-contour was adopted. This is the C-27, having less resistance and a higher lift at high speed than any wing ever tested. This shape was evolved in the Curtis aerodynamic laboratory.

Streamline caps were fitted around all bolt heads and fittings, which project into the air stream. Corners and angles formed by the intersections of surfaces were filled and rounded out with Balsa, the lightest wood existing. Wire terminals were encased in smooth shells which tremendously reduced their resistance.

An original idea was carried out for covering the spaces between fixed and movable tail surfaces; that is, between fin and rudder and between stabilizer and elevators. Strips of sheet rubber were spread across the openings, attached at the edges with linen tape, leaving the surface perfectly smooth at all times, but not restricting the proper movements for control.

A most important change has been made in the contour of the wheels. The most up-to-date method of streamlining a wheel has been to cover the sides with linen. Curtiss Engineers set about to improve on this with the result that a saving of 37 per cent. of the wheel resistance was affected. The result was accomplished only after extensive calculations and tests had been made. Several wheels of varying side contour were tested in the Curtiss wind-tunnel, where their relative merits were determined by scale balances showing the resistance of each. It was found that a wheel with a full elliptical section went through the air with the greatest saving of power. Building out the sides of a wheel to the determined contour was easily accomplished with sheet aluminum discs, covering the whole unit, discs and tires with linen, doped and varnished. The use of these wheels gave the machine an increase in speed of 1.3 miles an hour, equal to a total saving of 10 horsepower for both wheels at high speed. Streamlined cast aluminum hub caps and a streamlined tailskid completed the landing gear improvements.

Trivial as some of the changes appeared, and in spite of the extra weight their incorporation necessitated, the additional speed and efficiency obtained indicates the advancement being made by practical engineers of the largest pioneer aeronautic organization constantly engaged on improving the best existing aeroplanes, employing the most modern testing equipment and methods.

Lighthouse Developed for Night Flying

IN preparation for the night flying which will soon be undertaken by governmental and civilian aviation interests, the Aeronautical Chamber of Commerce announces the development of two types of aerial lighthouses to mark and illumine the way from New York to San Francisco. One of these devices, a beacon, is already in operation at Hampton Roads under the supervision of the Navy Bureau of Aeronautics; another a ground wind indicator, is being installed by the Army Air Service at Dayton, Ohio; while the Post Office Department, as was indicated recently by Colonel Paul Henderson, Second Assistant Postmaster General, is negotiating for equipment to be installed either between New York and Chicago or Chicago and Cheyenne.

The development of these lights is another indication that the United States is not lagging in aviation. At Elizabeth, N. J. is located the plant of the American Gas Accumulator Company, the United States unit of an international corporation. Immediately after the Armistice, the British Air Ministry requested the Englsh unit of this corporation to work on the "uminating problems of night flying with : result that lighthouses were established · the London-Paris route, first at Croy- near London, and later in Kent. The rican unit, which had specialized in .ne and lighting signalling devices, began where the British unit left off and is now carrying on experimentation which promises significant development in the near future.

"The problems of night flying," according to E. R. Boots, General Manager of the American Gas Accumulator Company, "resolves itself mainly into a question of setting signals to keep the pilot on his route and so illuminating emergency fields and terminals that he can land safely into the wind. With the present encouraging application of radio and utilization of the compass in aerial navigation, the ground light is of primary importance. We consequently have developed what is known as the *Aga* Automatic Ground Wind Indicator. This apparatus has been designed to fulfill the purpose its name implies, and it is intended to act as a signal to aviators both by day and night. It is intended for use upon emergency and other landing grounds where no personnel is available. The whole unit is entirely automatic in operation and when installed in its permanent position it will be equipped to operate without human attention of any kind for periods of six months to one year. It is in the form of the letter T, and very nearly approximates the style internationally agreed upon to indicate landing zones. The three vanes are mounted in such a manner as to receive upon their upper surfaces light projected through the dioptric lenses fitted round the light source, and these lenses together with the vanes are free to rotate about a vertical axis. By the employment of a suitably designed rudder the head of the T unit is equipped with the Gas Accumulator wind. It stands five feet high.

"The light power projected upon each of the vanes is 27,000 E. S. candlepower. It can be seen as a day signal at a range of about .5 miles when observed from normal flying heights. As a flashing light without definite shape, it can, at night, be seen from about 12 miles, and its shape and bearing can be clearly established from a distance of two to three miles. This unit is equipped with the Gas Accumulator Company's Sunvalve and gear for automatically changing mantles.

"The sunvalve is an interesting feature. It is worked by the action of solar radiation and is so designed as to be operative under any temperature changes. Briefly, the system employed is that a central black body is surrounded by highly polished pillars; light, and therefore heat, falling upon these elements, is absorbed by the black center and reflected by the outer gilt columns. Consequently the black portion expands under a given influence to a greater extent than the polished elements; this difference in expansion is utilized to open and close a gas valve,

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turning the light off and on according to the prevailing degree of light and darkness. A valve of this type brought the Croyden light into action during the last eclipse of the sun.

"It is a light of this type that we are installing at Dayton, for the Army. It has been our recommendation for both the Army, along the Model Airway, and the Post Office Department, on the Chicago-Cleveland Route, that they survey the route to determine suitable emergency landing fields, which shall be located not more than twenty miles apart, and that one of these automatic Ground Wind Indicators be installed to mark each of these fields, so that a flier can hop from one to the other, and in case of a forced landing, will always be able to glide to the field ahead of him or the field over which he has just passed. He will be able to determine the direction of the ground wind when he gets within three miles of the field, and by having these lights located in the same position in each field, the flier will be able to determine his landing space from the location of the light.

"As the ground lights will not be visible for great distances, it will be necessary, just as with marine transport, to provide great beacons for the airways. The *Aga* Beacon has a light range of over 35 miles.

It is a small unit of this general type twelve months without attention. It is of the revolving type, the rotation of the lenses being obtained by the movement of certain sensitive diaphragms which are operated by the gas passing under pressure to the burner; on the light being extinguished by a sunvalve the optic ceases to rotate.

It is a small unit of this general type which is now being tested by the Navy at Hampton Roads.

"Our aeronautical engineers recommend that one of these large revolving aeronautical lights of very great candlepower be located at convenient points along the route that is to be flown by night at distances of forty or fifty miles apart. These lights are to be located on promontories where they will have the maximum range of visibility, and will have a code flash so that each one may be identified by the flier. Their value will be to lead fliers back to the airway in case they stray from it on account of fog or storm. These lights also have the advantage of giving the aviator definite information regarding his location when he has returned to the route, or when there is a question of his position after flying above clouds or through fog. These lights are similar to the ones which are giving the British Air Service so much satisfaction on the London-Paris Route."

Simple Formula for Estimating Aeroplane Ceilings

By Walter S. Diehl

Summary

THE absolute ceiling of an average aeroplane is given to a close approximation by

$$H = 19000 \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)}$$

where

H = absolute ceiling, in feet

$\left(\frac{W}{HP}\right)$ = "power loading," based on full load and normal B.H.P.

and

$\left(\frac{W}{S}\right)$ = wing loading, based on full load.

The aeronautical engineer often has occasion to estimate the absolute ceiling of an aeroplane for which a detailed performance calculation is out of the question. In such cases it is customary to use either empirical performance charts of formulæ. The performance charts which are given in several of the recent works on aerodynamics and performance are satisfactory so long as the aeroplane under consideration does not depart too far from the average in its characteristics. The formulæ, with one exception, are no better. This exception is developed by Kann in Technische Berichte 1-6 and is of the form

$$H = C_1 \log_{10} \frac{C \frac{C_L^2}{C_D^2} \eta^2}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \qquad (1)$$

where

H = absolute ceiling

η = propeller efficiency

$\left(\frac{W}{HP}\right)$ = power loading $\left(\frac{\text{gross load}}{\text{normal BHP}}\right)$

$\left(\frac{W}{S}\right)$ = wing loading $\left(\frac{\text{gross load}}{\text{wing aera}}\right)$

C_L = absolute lift coefficient

C_D = absolute drag coefficient

C_1 & C_2 = constants.

The chief criticism of this formula is that it is too complicated for extensive use.

Experience has shown that the terms $\left(\frac{C_L^2}{C_D^2}\right)$ and η^2 may be neglected without seriously affecting the results given by the formula. That is, we may write

$$H = K_1 \log_{10} \frac{K_2}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \qquad (2)$$

and determine appropriate values of the constants K_1 and K_2 by calculation or from reliable performance data. Obviously K may be arbitrarily assigned any value which will cause the term within the brackets to assume a reasonable value.

K has been determined for a number of The average value of $\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)$ is of the order of 1000 and it is desirable that the log term be about unity.

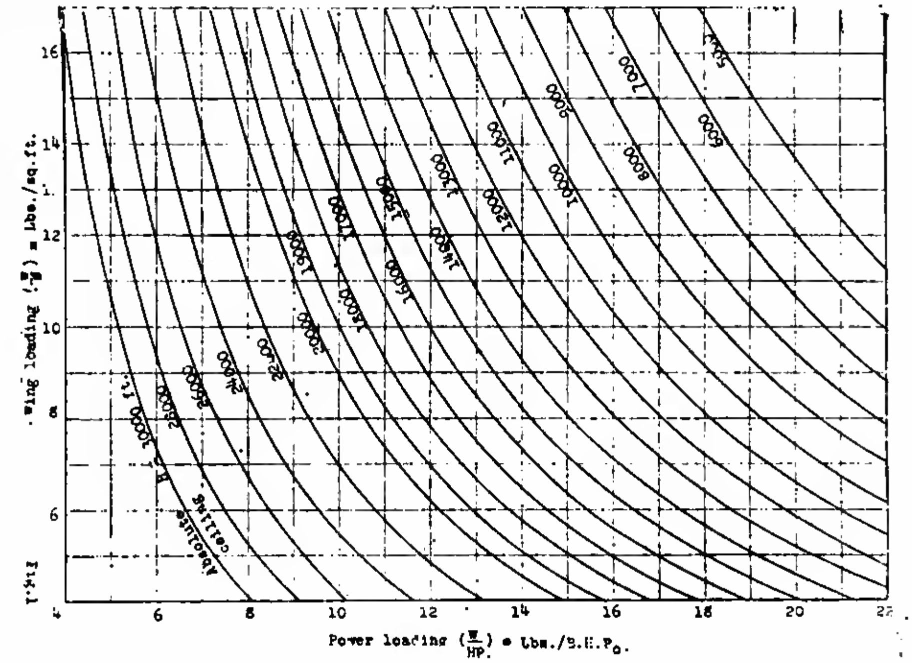
$$K_2 = 10000 \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

fulfils this reqnirement and the formula may be written:

$$H = K \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2 \left(\frac{W}{S}\right)} \ldots\ldots\ldots\ldots\ldots\ldots (2a)$$

aeroplanes of all types and is found to have an average value of 19000 with individual values ranging from 17500 to 21000. In most cases, however, the value is quite close to 19000 as shown by Table 1, which contains a few representative determinations of K.

(*Concluded on page 571*)



Torpedo Planes Hit Atlantic Fleet

ON the morning of Wednesday September 28, 1922, the Atlantic Fleet, consisting of three battleships, the *Wyoming*, *Arkansas* and *North Dakota*, were approximately fifty miles off the Virginia capes, in company with a squadron of destroyers to the number of approximately thirty, airplane torpedo and bombing squadron No. 1 of twenty 'planes the C7 Navy airships, and a number of pursuit craft, for the first maneuver ever held in which torpedo-carrying airplanes operated against ships. Eighteen of the twenty 'planes carried torpedoes while the other two carried the commanding officers of the squadron.

Preparations had been made for the scouting 'planes of the Atlantic Fleet, twelve in number, to accompany the torpedo planes in their flight through the capes from the Naval Air Station at Hampton Roads to sea in the attack against the battleships. The C7 airship from the Hampton Roads Station also took part in the maneuvers. In addition, there were naval planes from Washington carrying officials from the Navy's Bureau of Aeronautics for observation purposes.

About 9.30 in the morning, the torpedo 'planes left the beach and proceeded to sea in formation. When the first 'planes were sighted by the ships, the fleet was headed about due East, and rapidly overhauled by the attacking 'planes. The first attack was made at 10.18 a. m. The battleships were maneuvering at high speed to keep the 'planes astern but the squadron of aircraft divided and attacked from both flanks. The *Arkansas*, the target ship and the one on which the Press and officials were carried, sustained seven hits out of 17 shots fired, all close aboard. *that did not hit ran* close oboard. The eighteenth torpedo was not discharged, and was carried back to the base.

The 'planes flew to within about a thousand yards of the ship, dove from an altitude of about 500 feet to within a few feet of the surface of the water, dropped their loads and then zoomed up and away to avoid theoretical raking fire from the decks of the ships.

The dreadnaught depended only on the skill of their navigating officers and their rudders in their efforts to avoid theoretical destruction by the torpedoes launched by the attacking squadron.

The fleet was supposed to be approximately due east of Cape Henry, at a distance of about fifty miles, the definite location being determined by observation of the airship C7 hovering over the fleet and the smoke which was discernible for twenty miles.

The scouting 'planes went out principally to render assistance to the torpedo 'planes should they chance to get into difficulties and to aid in the recovery of the torpedoes after they had been fired. All torpedoes that were fired worked perfectly.

Radio or other signals between aircraft or between the ships and the aircraft were not used in the trial. The 'planes used are known as the PT type, 2-seater, and are old as to type.

The characteristics of the PT 2 (two-seater torpedo plane) are as follows:

Power plt.—Libty. 400 h.p.		
Weight empty		4475 lbs.
Useful load		
Crew, 2	360 lbs.	
Gasoline	483 lbs.	
Equipment	30 lbs.	
Ordnance	1707 lbs.	2580
Total weight		7055 lbs.

Per cent Useful Load 36.5; lbs./sq. ft. 8.8; lbs./h.p. 17.6; 112 gal. gas; 10 gals. oil; endurance full load 2 hrs; cruising endurance 3 hrs; wing curve RAF 6; chord 6' 3"; gap 7' 7½" in front, 7' 5" rear; height 16' 7½"; stagger O; dihedral 2 deg.; backsweep O; angle incidence, upper 5½ deg., lower 4 deg.; float tread 13'2 3/16"; armament torpedo and 1. Lewis.

Surface areas as follows: wings, inc. ailerons 808.5 sq. ft.; ailerons 105.4 sq. ft.; stabilizers 54.8 sq. ft.; elevators 45.6 sq. ft.; fin 13.2 sq. ft.; non-skids 17 sq. ft.; rudded 23.8 sq. ft.

Performance: 85 m.p.h., climb to 2000 ft. in 11 mins., and to 3000 ft. in 19 mins.

This plane was designed and built in the Naval Aircraft Factory at Philadelphia.

The PT1 is similar save that it is a 1-seater and the weight empty and the useful load is slightly less.

The Navy Bureau of Aeronautics has been working along consistent lines for the past year in the development of suitable torpedo planes for speed, maneuverability and distance. This work was carried out in recent tests at Anacostia air station of dif-

Showing the wake of a torpedo dropped from a plane in the recent naval maneuvres. A hit was registered

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ferent types, the Blackburn "Swift", the Fokker and the American-designed Davis-Douglas, which proved its superiority and has been placed into production. These planes will be in the fleet early in the coming year.

650 H. P. Torpedo Craft

There is still further development work going on looking to the 1923 building program in which a new engine of 650 horsepower is to be incorporated in a new torpedo scouting and bombing 'plane. This engine is making its first appearance in the Pulitzer race in the "NW" or Navy-Wright 'plane, which has been especially constructed around this engine. The Pulitzer race is being taken advantage of for test. This engine expresses the highest development in power/weight ratio that has yet been evolved in aircraft so far as is known to the experts in the Bureau of Aeronautics. In order to place this plane and engine in the race and secure a test under such severe conditions, the manufacturers have been working at top speed to rush this 'plane through, to the end that they have shipped the machine to Detroit where it will be assembled and flown.

An entirely new torpedo scouting and bombing plane will be built around this engine if results are as expected for the future service work.

The racing 'plane has a spread of 30 ft. 6 ins. for the top wing, 17 feet for the lower, and incorporates all the features known in streamlining. The wheels are streamlined and enclosed in "pantaloons" and all wires are streamlined.

In a despatch to the Commander in Chief of the Atlantic Fleet the Secretary of the Navy speaking for the Navy Department expressed appreciation of the excellent results that were obtained from the torpedo plane practice held off the Virginia Capes.

Secretary Denby in his message to the Admiral emphasized the fact that the successful maneuvers conducted with torpedo planes and battleships was a high tribute to the efficiency of the Fleet organization and showed that Naval Aviation was being developed along sound constructive lines as strong and aggressive arm of the Fleet.

The Secretary's despatch read:

"Reports from the Commander-in-Chief and returning observers indicate that the torpedo plane practice completed off the Capes was well executed and that the maneuvers both by the planes in attacking and the battleships in avoiding attack demonstrated a high state of efficiency. The one hundred per cent performance of the torpedoes was most gratifying and creditable. The participation of forty planes and one dirigible and their prompt return to their bases after maneuvers seventy miles off the coast indicates the excellent condition of these forces. The Department is well pleased with the results of this practice and the advancement in the tactical use of the fleet torpedo planes that it demonstrated.

Report of International Conference on Standardized Airship Fittings and Operation

THE report of the international conference held at Australia House, London, February 14 to 17, 1922, to consider the question of standardizing certain airship fittings and operation, has just been made.

This conference was attended by the following: *British Empire*,— A. H. Ashbolt, Agent General for Tasmania, Tasmania, R. A. F., Chairman, and Major Scott, A. F. C., *France*—Captain Sable, Air Attache, and Lieut. de Vaisseau Joughland; *Germany*—Major Stelling, of Parseval Airship Co., anad Commander Herrara, of the Zeppelin interests; *Italy*—Major Graziani, Air Attache; *Russia*—Mr. Akasheff; *Spain*—Commander Herrera, managing director of the Spanish Argentine Co.; *U. S. A.*—Major H. C. Geiger, U. S. Army, Commander Dyer of the Navy, and Mr. E. Wellington Butt, representing commercial interests; *Hon. Sec.*—Commander F. L. M. Boothby.

In addition to the countries represented by delegates, Japan, Switzerland and Czecho Slovakia intimated their acceptance of the principle and asked for copies of the report.

It is called to the attention that the meeting was a strictly private one of experts of different nationalities to consider and discuss matters of common interest in airship communications.

It was the unanimous opinion of the conference that the following resolutions should be accepted by the nationalities concerned and that all airships and airship stations built for international purposes should make provision for these recommendations:

1. "The principle of standardization is accepted.
2. "Standardization means such an arrangement as permits the airships of one nation to use the landing, mooring, gassing and refueling arrangements of any other nation.
3. "Each country retains for itself the right to receive airships by either or all of the following methods:
   At air sheds
   By mooring on the ground
   On water
   By 3-wire mooring arrangements
   By mooring masts.
4. "When airships are landing at shed, on the ground, or on the water, that all trail ropes, pulley blocks used in connection therewith and handling guys be standardized.
5. "Any country adopting the principle of mooring to masts, shall provide that such masts and ships be provided with standardized couplings, water, petrol and gas connections.
6. "This Committee recommends to the next international air conference the formation of a committee to determine the airworthiness of airships. It is recognized that the conditions of airship travel vary according to route and season of the year, consequently the impossibility of laying down a definite margin of fuel and ballast to be carried. The situation can best be met by a formation of a small permanent committee to determine margins for each route according to its merits.
7. "Each country be asked to create an official register of airships in which will be listed all airships and air stations indicating such airships and air stations as comply with the 'international standards' hereinafter arranged.
8. "Pending the decision of the Commission Internationale de Navigation Aérienne, it is resolved that the Council of the Aeronautical Society of London be asked to permit their secretary to receive correspondence referring to 'international standards' and, if desirable, to authorize him t oconvene a further conference. In such event, invitations will be forwarded to the countries interested through the air attaches of the embassies in London.
9. "Lloyds and insurance companies in different countries be informed of the resolutions and standards adopted by the Conference with a suggestion that such standards be adopted by Lloyds and insurance companies as the basis upon which minimum rates of insurance will be fixed.

Standards

10. "The metric system of measurement be adopted.

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11. "All rigid, semi-rigid and non-rigid airships over 15,000 cubic meters capacity be required to carry:
    a—A trail rope of not less than half the length of the ship with a minimum of 100 meters.
    b—The forward side guy ropes to be such a length as to reach not less than 40 meters below the lowest point of the airship.
    c—Eyes to which other guy ropes can be secured.
    d—Some method of hauling down the stern.
12. "Air stations are required to provide:
    a—A landing block capable of taking the largest trail ropes carried by an airship.
    b—Side guys and toggles suitable for airships of any size.
13. "All gas, fuel, water and oil coupling pipes shall be fitted with 'international' right handed threads.
14. "In addition to facilities provided in sheds for refueling airships similar facilities should also be available on the landing grounds.
15. "This Conference recommends the following sizes as most suitable for the flexible connection between airships and mooring masts or air stations.

    Gas connections, inside measurement—300 millimeters
    Water connection, inside measurement— 75 millimeters
    Fuel connection, inside measurement— 40 millimeters
    Airships containing pipes of dimensions other than those indicated to have such arrangements installed as will enable their pipes to connect up with the standards recommended herein.
16. "Air stations are to be fitted with female connections, airships with male connections.
17. "Airships designed for mooring to mast must carry a cone gimballed on to the ship and rotating on its own axis. The size and shape of such cone to be that shown on the attached drawing. The wires passing through such cone shall not exceed a diameter of 18 mm. Such landing wire must be fitted at the outboard end with a splice, the eye of which shall be 230 mm. long, also as shown on attached drawing.
18. "The mooring mast station must provide similar rope fitted with a quick coupling to take a loop at the outboard end of the trailing rope. The mast must be fitted to take the rope (up to 18 mm. diam.) together with the necessary coupling.
19. "Suggested signals for mast mooring.

    At stations
    At Day
    At Night and in Fog

    The position of the mast mooring wire will be indicated by
    A White Patch
    A White Light Waved
    When the mooring wire ropes have been secured, the ground will signal the airship by
    Waving a White Flag
    A White Light Flashed
    When the airship is ready to haul down the ship will indicate by
    A Green Flag
    A Green Light
    To stop hauling the ship will indicate by
    A Red Flag
    A Red Light
    To ease away the ship will indicate by
    Red and Green Flags shown together
    Red and Green lights shown together
20. "The standards arrived at remain in force for two years when the whole question can be considered in the light of further experience then gained. If at any time, any important development occurs or fresh inventions, or if by practical experience standards adopted are found dangerous, the Committee will immediately be convened to establish fresh standards.
21. "A hearty vote of thanks be passed to Sir Joseph Cook, the High Commissioner for Australia, in granting the use of the rooms for the conference."

It is unfortunate that there exists in the United States and in Germany, and to a lesser degree, in England and France, no national agency empowered to put into force any such regulations as these or other that may be no matter how advantageous for the advancement of navigation.

For the present, it seems, that there can be maintained by the Army and Navy of respective countries lists of airships and airship stations, with data thereon, for the information of other countries and agreements arrived at unofficially.

In the matter of mooring masts, the art is still exceedingly young and many and varied are the designs extant. It has been possible, it will be noted, to confine restrictions as to these to but a minimum of items.

Curtiss Model D-12 Aeronautical Engine

THE Curtiss model D-12 engine is a development from the Curtiss model CD-12 engine of the same bore and stroke. After exhaustive tests on the model CD-12 it was decided to entirely rebuild the engine to decrease the weight if possible, increase the reliability if possible and improve the present fine accessability. The seven-bearing crankshaft was retained as well as the well known use of main bearing caps on the crank-case. The distribution of the bearing areas on the main journals was changed to conform with Air Service requirements. This change necessitated the making of entirely new patterns and forging dies for all the main parts of the engine. A careful study was made of each individual part on the engine during this redesigning in order to save weight as well as increase the strength if possible. The details of changes in the various parts of the engine are outlined below. The result of this redesign was an engine weighing 35 pounds less than the model CD-12 developing 10 to 15 horse power more at the same speed.

The Curtiss D-12 engine of the 60 degree Vee type consists of two rows of six cylinders en bloc having a bore of four and one half inches and a stroke of six inches with a total displacement of 1145 cubic inches. The engine is of the aluminum cylinder type with inserted steel sleeves in contact directly with the cooling water. The engine uses two overhead camshafts per cylinder head driven through bevel gearing and operating four valves per cylinder.

Cylinder Head Construction.

The same cylinder head construction as used in the CD-12 engine has been retained. Steel cylinder sleeves of carbon steel hyrdaulically forged with one end closed are rough machined, heat-treated and then finished machined before assembling in the cylinder head with the exception of the final grinding of the bore. The threaded portion of the sleeve is approximately one and one half inches long at the upper end. Careful machining is done on these sleeves and the cylinder head to maintain a perfect joint between the aluminum head and the steel sleeve. An integral stud on the end of the closed head of the sleeve passes through the water jacket thereby improving the contact between the steel head and

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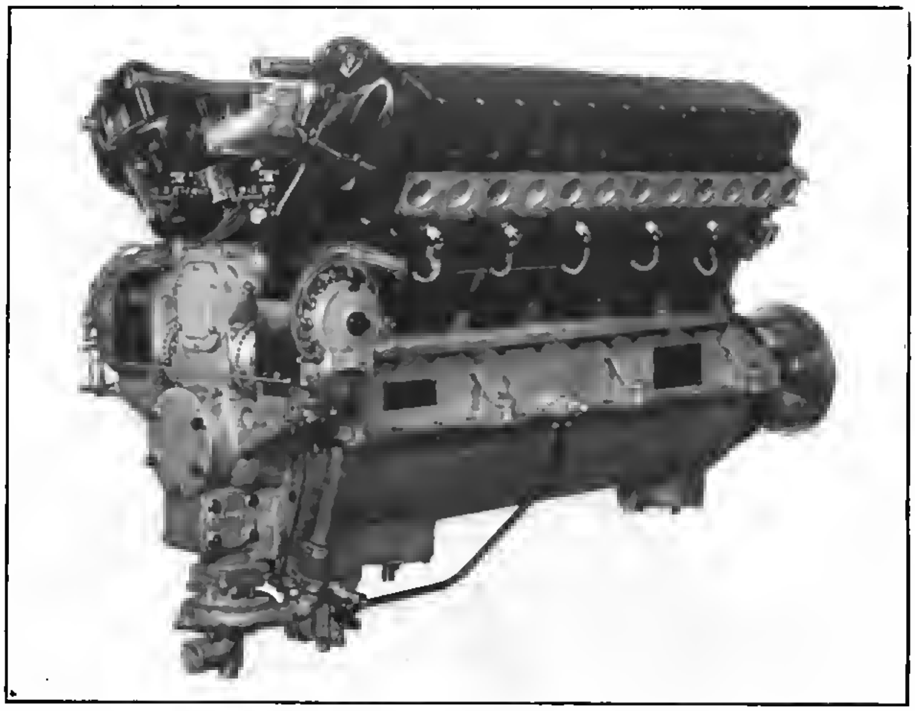
the aluminum head. The valve port holes are machined after the sleeve is assembled. Spark plug bushings are also assembled after the sleeve is in place, duralumin bushings being used in place of brass as was former practice. The aluminum water jacket which is cast in one piece for six cylinders is assembled over the lower end of the six sleeves, the water joint being maintained between the sleeve and jacket by a composition gasket under the flange on the sleeve. The upper joint is made tight with a copper asbestos gasket. The sleeves fit very snugly in the water jacket at the lower end which gives them ample support to prevent the thin sleeve from going out of round.

Reduction in valve size of .040 inches was found necessary to make the valves removable from the cylinder without removing the valve guides. This slight decrease in valve size had no effect on the power since the power is actually higher in this new engine than in the CD-12 engine.



Magneto end view of the Curtiss CD-12 Aero Engine

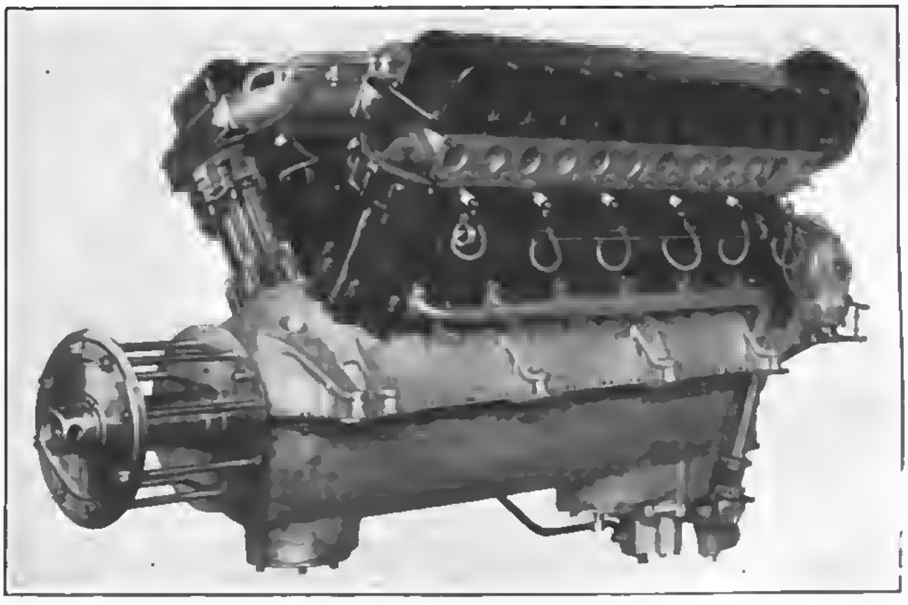
Valve Mechanism.

Each cylinder is fitted with four steel tulip valves, two intake and two exhaust which are interchangeable. These valves seat directly in the steel cylinder head as in former practice. The camshafts are mounted on the top of the cylinder heads on six aluminum brackets, the shafts running directly in the aluminum. These brackets are carefully dowelled to the head and are interchangeable, no alignment, reaming or hand scraping being necessary during manufacture or overhaul. The intake camshaft is driven by the exhaust shaft thru spur gears at the anti-propeller end. A bevel gear is mounted on the exhause camshaft in a novel way. The spur gear on the exhaust shaft is extended beyond the width of the normal gear and the bevel gear is internally splined with a Fellows gear shaper to fit over this extension. A single large flanged nut holds this gear on the shaft. Owing to the fact that the number of teeth on the spur gear differs from the number of teeth in the bevel gear a very fine adjustment is obtainable on the timing by shifting the gear in relation to the shaft.

One cam operates two valves through a Tee shaped tappet working in a bushed hole in the cylinder head. This tappet has been redesigned to increase its strength, reduce wear and facilitate production. This type of tappet removes all side thrust from valve stems. The valves are adjusted as before by adjusting screws clamped in the ends of the Tee tappet. The camshaft bearings are lubricated by oil pressure of approximately 10 pounds per square inch and the Tee tappets and valve guides are oiled by splash.

Crankshafts

The crankshaft is one of the conventional seven-bearing type being made of low chrome nickel steel. The crankshaft has been redesigned to take care of the redistribution of the main bearings, the center bearing being 1¾ inches effective length and the balance of the bearing 1-½ inches thereby doing away with the three 1" bearings used in the CD-12 engine making larger bearing surfaces and decreasing manufacturing costs. The same journals and crank pin sizes of 3 inches and 2½ inches respectively have been retained. The crank cheeks have been made oval instead of rectangular increasing the width ¼ inch and decreasing the weight of the crankshaft at same time giving a stronger and lighter shaft. The same type of propeller thrust bearing is used on this engine mounted between No. 7 and 8 main bearings, namely, a deep-grooved radial annular ball bearing. This



Propeller end view of the Curtiss CD-12 Aero Engine

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bearing takes thrust in either direction and the method of mounting adds greatly to the rigidity of the propeller in flight and gyroscopic forces are well taken care of by this arrangement.

Crankcase

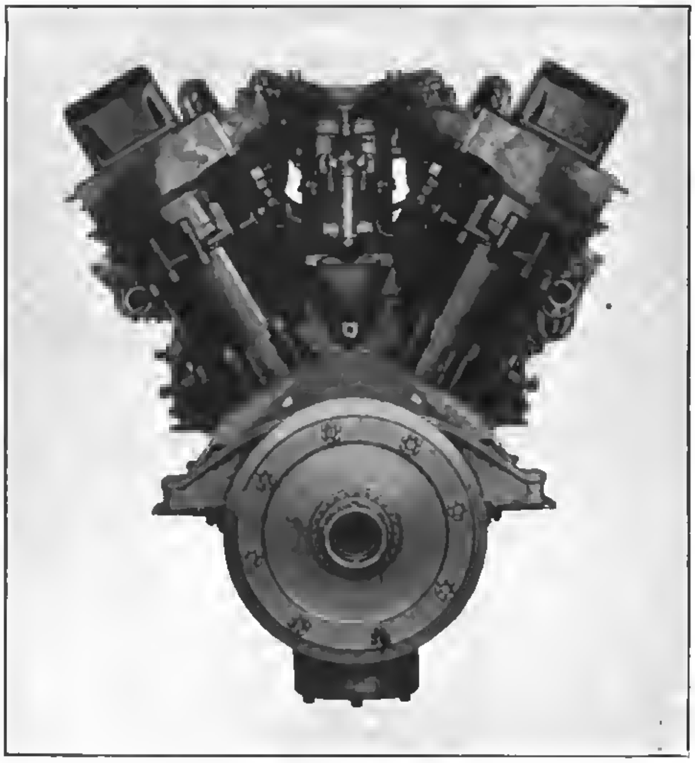
The upper half crankcase cast from an aluminum alloy is practically the same as on the CD-12 with the exception that the nose has been shortened after removing the propeller and electric started bosses. The cast aluminum main bearing caps have been replaced by duralumin forgings having four times the strength for the same weight. Each cap is carefully keyed to the crankcase to prevent it from shifting during operation.

Bronze backed babbitt-lined bearing shells are used, held in place by countersunk head brass screws. The babbitt bearings are bored to size in a boring mill, thereby maintaining the clearances in all bearings the same and insuring perfect alignment.

Accessory Drive Shaft and Gearcase

On the anti-propeller end of the engine is mounted a typical gear-case as used on this type of Curtiss engine. The gearcase has been redesigned to provide better accessibility and to make provision for mounting of the Air Service gear gasoline pump as well as gun generator drives. The use of this type of gearcase facilitates production and permits lighter weight. As used in the CD-12 engine all shafts and gears are assembled using stub-tooth teeth as splines. Altho the engine has a 60 degree angle between cylinder banks, the vertical drive shaft is brought to a height where 90 degree drive shafts run directly to the bevel gears on the exhaust camshafts. The tachometer drive has been removed from the vertical shaft which runs 1½ crankshaft speed and has been taken off of the left hand exhaust camshaft thereby simplifying the design and making the drive more accessible. All gears have stub teeth.

A very satisfactory magneto coupling drive has been developed for the D-12 engine. This drive consists of a combination of an Oldham coupling and thermoid disc with a micrometer adjustment obtained by the use of a series of holes of different total number in two discs. The Oldham coupling takes care of all offset and thermoid disc takes care of angular misalignment as well as protecting the magneto from gear shocks.



End view of the Curtiss CD-12 Aero Engine

The water pump design has been changed to provide a ball bearing in the water pump in place of a plain bearing and a splined shaft drive in place of the squared coupling formerly used. Adequate glands have been provided to prevent both oil and water leakages. An Alemite connection is used on the water gland to keep the packing lubricated to prevent leakage. The lower vertical drive shaft is designed to drive the Curtiss triplex plunger gasoline pump in Army Air service gear pump the upper end of the upper vertical shaft is indirectly splined for a Liberty generator. The gear-case is provided with a boss to take the Bijur anti-propeller end starter.

Pistons

The same type of piston is used as in the CD-12 engine, being the ribbed head type, which gives a light weight piston of considerable strength. The rings have been lowered to provide a wider top land and to make the rings all the same width, namely, 3-32.

The piston pins float in the pistons and connecting rods being held in place by means of piano wire snap rings. There has been no change in the connecting rod assembly, this being the articulated type, the short rod being forked over a boss on the master rod. Non-gran bushings are used for the wrist pins and piston pins.

Lower Half Crankcase

The lower crankcase has been entirely redesigned to eliminate the oil tank which was formerly built into the engine. The oil pump was also redesigned, three separate pumps being used instead of the three gear suction pumps and the two gear pressure pumps. By this means weight was saved and the drive of the pump was greatly simplified. The oil pump is driven from the lower vertical shaft in the gearcase thru spur gearing, a team of three gears being used. The middle gear is adjustable to obtain the proper gear back lash without necessitating careful machining for center distance.

Carburetion

At the present time the engine is fitted with two Zenith U. S. 54 carburetors which have beeen rebuilt to provide parallel throttles and an improved mixture control. These changes with the proper carburetor setting has given an extremely flexible engine coupled with wonderful acceleration without sacrificing maximum power. The two carburetors are inter-connected with a cast aluminum air duct, which obtains its air through a sheet aluminum ai stack from outside of the airplane body.

Ignition

Two single spark 12 cylinder Splitdorf magnetos model SS12 are used

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for ignition on the engine feeding two spark plugs per cylinder placed diametrically opposite. One magneto is wired to the exhaust plugs and the other to the intake plug. The use of these magnetos has resulted in the saving of over six pounds total weight without a sacrifice of performance or reliability.

Cooling System

The cooling system had only a few slight changes. The pump has been redesigned as stated above, the double shrouded type of impeller being retained. The capacity of the pump has been increased slightly. As before the pump delivers water thru a distributing manifold on the lower end of each cylinder block, discharging at the top into another manifold.

This engine has been designed to use water manifolds for the outlet directly on the cylinder head thereby eliminating the objectionable feature of passing water thru the intake manifold gasketed joint.

Lubricating System

The conventional Curtiss lubricating system is used on this engine, being refined to such a degree that a consumption of .015 pounds per B. H. P. per hour may be used as an average figure for continuous flying. Minimum figures of one half this value have been obtained in block testing. The scavenging pumps, which are now entirely separate eliminate any chance of air entering the system and thereby destroying the pump capacity. These scavenging pumps have been increased fifty per cent in capacity. All plain bearings in the gearcase are pressure fed with the exception of the lower vertical shaft which runs in a bath of oil. All other bearings are splash fed by the oil running back from the camshafts which are carefully housed in with an oil tight housing.

Propeller Hub

The propeller hub has been redesigned so that standard Liberty bolt size and bolt circle are used. A novel use of duralumin has been made by the use of this material in the loose flange.

Gasoline System

The gasoline system used on the high speed airplanes using the D-12 engine consists of the Curtiss triplex gasoline pump feeding gasoline directly to the carburetor, an overflow being provided from this pump to take care of the over capacity of the pump. The gasoline is fed with a relief valve to maintain a constant pressure. This type of pump gives positive priming and unusual reliability since the pump is oiled under pressure against leakage past the pistons and the speed of 325 r. p. m. is very low.

Summary

With the above changes, an engine has been obtained weighing 670 pounds without water and delivering 400 B. H. P. at its normal speed of 2000 r. p. m. By the use of higher compression ratios and doped fuel as well as higher speeds this power is materially increased so that the result is an engine which develops a minimum of 430 horse power at 2100 r. p. m. The engine has been submitted to a Navy 50 hour test showing very good performance and other tests are now being conducted during the production of more engines.

The B. M. E. P. obtained in this compact engine are as high at 2000 and 2200 r. p. m. as obtained usually in an engine running at 1800 r. p. m. The Curtiss D-12 engine represents more nearly the ideal airplane engine than any other motor owing to its light weight and low head resistance per horse power which allows the engine to operate at light power having a tremendous reserve power for emergency coupled with reliable operation at full power.

Uppercu, President of the A. C. C. One of America's Most Enthusiastic Supporters of Aviation

IN the election of Inglis M. Uppercu as president of the Aeronautical Chamber of Commerce, a pioneer in American aviation, who has hitherto remained comparatively little known, come prominently to the front. He is unique in the automotive world, in that he has for years been one of the most successful distributors of motor cars, and as such is a powerful figure in the automobile business, while throughout a long period he has consistently devoted a considerable portion of his income to the development of flying.

The aircraft industry is probably the most talked of industry in the country today. Hardly a group of business men assembles without a discussion of aeronautics. Yet, as Mr. Uppercu once phrased it: "If you passed the hat you wouldn't get a nickel." The difference between the new head of the Aeronautical Chamber of Commerce and many of the talkers is that Mr. Uppercu backs up what he says. First and last, in the past twenty years, he has invested nearly $30,000,000 in aviation, first in experimenting and later in scientific research and the practical operation of aircraft.

Mr. Uppercu was born in North Evanston, Ill. As far back as he can remember kite flying held him fascinated. When he was a little boy his parents moved to Montana and there, in the winds that frequently swept the hills and high plateaus of his father's sheep ranch, Inglis had opportunity to test new kites and to dream, like so many others have dreamt, of following the eagles in their swift strong flight. His Grandfather Hildebrand loved kites, too, and together the old man and the little boy would construct new devices for the air. Whenever the father took Inglis on even the shortest trip from home, the lad, on his return, would invariably find Grandfather Hildebrand with a new kite sailing high to welcome him back.

As he learned to read, Inglis obtained a set of books called "Science For All" and the flying and balloon sections of these, meager enough at that time, he learned almost by heart. So convinced did he become that it would be possible for him to fly that, when about 5 years old, he built a "flying machine." A cracker box was the fuselage and the first wings were made like kites, but they appeared too flimsy. So the boy obtained a pair of eagle's wings and tacked them on. With his sister, a few months older, he held many conferences as to the time they would be gone, where they should go —the provisions they should take. At last, one night, when, in the clear air, the brilliant stars came close enough to reach, Inglis and his sister dragged their "airplane" to the roof of the shack, and were about to "take off" when their father interfered.

The next stage came several years later. The family were living in St. Louis. Next door was the home of a mechanical experimenter who was later to make a name in the automobile industry—Chas. E. Duryea. Mr. Duryea's immediate problem— it was in 1886 or '87—was to make the primitive high wheel bicycle safer. But he and the youth use to talk about flying and Mr. Duryea made many models which sustained

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the youth's interest and hope. Mr. Duryea soon went to live in Washington and the Uppercus to New York. On one of Mr. Uppercu's visits to Washington, Mr. Duryea said: "Inglis, you and I will have to get a 40-acre lot and build a flying machine factory in the middle of it."

About 1890 Mr. Duryea had his work on the internal combustion engine well under way and gave Mr. Uppercu his first job. In 1901 or 1902 (the very time Langley and the Wrights were experimenting) Mr. Duryea built a 50 h. p. 3 cylinder airplane motor which weighed but three pounds, per horsepower, remarkably light considering the knowledge of the period. Mr. Uppercu's association with Mr. Duryea gratified the boy's ambition to work with "moving things" and Mr. Duryea's interest in flexing undoubtedly led Mr. Uppercu some years later, when the automobile business had enabled him to lay the foundation of a fortune, to give substantial aid to aeronautical research.

In 1908 Frank Boland of Rahway, N. J. built a tailless airplane that flew successfully many times. It was with Mr. Uppercu's help that Mr. Boland made his early experiments and it was with Boland, in the fall of 1908, that Uppercu took his first flight. What the boy, on the Montana plateaus, instinctively *believed* about the air, the man, now actually *felt*. The air was not simply an invisible, entangihle, ether; it was substance; it was stable; it was capable of supporting a man and a machine. The old Boland aircraft, crude as it was, has a distinct place in the progressive line which is manifest today in the planes and boats built by the Uppercu interests.

The investment of a few hundred dollars in 1908 was consistently increased and small plane and motor plants were built under Mr. Uppercu's patronage, first at Newark, then at Nutley and finally at Keyport, N. J. The firm was originally known as the Boland Airplane Co. In March 1914 it was desired to re-incorporate and it was Mr. Uppercu's aim to provide an expressive, descriptive name. He had the example of his automobile business. In 1902, when it became apparent that automotive transportation had before it a great popular future, Mr. Uppercu incorporated under the name of "Motor Car Company of New Jersey." So far as there is record, it is declared that this was the first notable use of the term and his friends credit Mr. Uppercu with actually having originated it. The aircraft company, in 1914 was well along in the development of marine flying craft. Mr. Uppercu then coined the word "Aeromarine" which has since become known the world over. The Aeromarine Plane and Motor Company thus came legally into being.

From 1908, when he flew numbers of times with Mr. Boland, Mr. Uppercu had not, up to the fall of 1917, heen in the air. It so happened that his reintroduction to flying came through a naval pilot whose idea of aviation was to scare his passengers and then pose as a hero engaged in a desperate occupation.

"When we alighted," said Mr. Uppercu, "I thought, 'If this is flying, it is folly to attempt to commercialize it.' So he set about learning the truth. He picked his own pilots and from that time on the word "Aeromarine" became synonymous with safety and sanity. "I had first to sell flying to myself," said Mr Uppercu, "before I could hope to sell it to others." So he learned to fly.

In the five years that have elapsed since that experience, Mr. Uppercu's operating company, Aeromarine Airways, has flown hundreds of thousands of miles transporting many thousands of passengers in comfort and security. He has established lines between Key West and Havana, New York and Atlantic City and Cleveland and Detroit. These services were the first in the United States and to date are the only ones maintained on schedule. The manufacturing corporation, the Aeromarine Plane and Motor Company has greatly expanded in the last few years and at present is engaged on War, Navy and Air Mail contracts aggregating one and a half million dollars.

Mr. Uppercu's chief automobile interest is the Cadillac Motor Car Company of New York, of which he is President.

The Silencing of Aircraft

THE muffler on an automobile is a requirement of law. It is natural to suppose that aircraft will be required to meet similar conditions the moment flying noise becomes a nuisance and this is only a matter of time when the volume of air traffic is sufficiently great. Legislation will eventually force aircraft muffling, even if the obvious advantages remain unheeded.

Military and Naval

The good results of silencing are obvious. These are set forth.

As airplanes, for example, can be heard from a great distance, long before they can be seen, listening devices which show location and distance enable the enemy to be forewarned and prepared. By muffling, machines can get nearer the enemy before being perceived and carry out their work at a lower altitude and with greater surety. At night, the advantage is probably increased.

The pilot and observer can carry on conversation without the use of signals or telephones.

By the use of a cut-out, signals can be made from one machine to another in formation flying. Signals may be made to the aerodrome.

The noise of the engine is an obstacle in radio communication.

The noise of an unmuffled engine has an undesirable effect on the pilot's system.

Though no regulations in the U. S. have thus far been made, it is obvious that aircraft will have to be muffled just the same as have motor boats and automobiles. Because of this novelty of aircraft, have they escaped prohibition of noise.

Passengers will want to converse during flight.

The continual roar of an engine is objectionable to the ears of paying guests. Every other method of transportation strives to afford the utmost in convenience and com fort.

The Noise of Flight

The noise caused by an airplane arises chiefly from two sources. These are: 1st, the noise of the exhaust gas leaving the engine. 2nd, the whirr of the propeller. Since the noise of the engine is much greater than that of the propeller, if we can deaden it, or do away with it altogether, we have done, perhaps, all that is necessary.

From a military point of view, it is necessary for the machine to fly absolutely without noise, either from the engine or from the propeller. The simplest method of reducing the noise of the propeller is to reduce its speed of rotation. The usual type of propeller re-

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volves at 1400 to 1800 r. p. m. Besides the inconvenience caused by the noise, this speed has the disadvantage of causing considerable loss of propeller efficiency. In order to avoid this double inconvenience, many aviation factories, especially in England, have long made engines with special gearing, reducing the speed to between 700 and 900 r. p. m. In most cases these engines are fitted with four-bladed propellers. This arrangement allows of reducing their dimensions, increasing the efficiency, and reducing the danger of breakage. The resulting lessening of noise is not perceptible, however, on account of the all-dominating intensity of the noise of the escaping exhaust gas.

It has, however, been proved that during a glide the noise is no longer audible from the ground, even when the machine is at an altitude of but 500 to 700 meters and the propeller is turning at 500 to 700 r. p. m. There is thus no doubt that the combined use of a geared propeller and a silencer adapted to the engine provides an almost perfect solution of the problem of the silent airplane.

The noise of the engine is caused by the energy of the exhaust gas which leaves the cylinder at great speed, with a considerable amount of heat, and at a presure of 5 to 7 atmospheres. The silencers used in automobiles are built on the principle of the discharge of the exhaust gas into voluminous manifolds in which the gas is forced to change its direction frequently, which tends to a reduction of speed. This method of deadening the sound has several technical defects of which the following are the chief: great volume, considerable weight, great resistance to escape and consequent loss of power in the engine caused by back pressure. Increasing exhaust resistance also causes over-heating of the cylinder walls. The silencer now used in automobiles causes a greater quantity of exhaust gas to remain in the cylinder after the stroke of the piston, the temperature of compression to be higher, combustion to be incomplete on account of the unfavorable composition of the gaseous mixture, the gasoline to mix in the cylinder with too much exhaust gas and the fouling of spark plugs and valves.

In Switzerland, where the authorities banned flying entirely near Lucerne until engines were muffled there has been developed the "Ad Astra" silencer, a note on which was published in *Aerial Age* of January 2, 1922. An observer reported: "There was scarcely any noise from the airplane during flight. At an altitude of 1000 m. only the propeller was heard. Other machines were up at the same time, and the difference between them and the one fitted with the silencer was striking. According to the date given by those checking the tests, there was neither loss of engine power, nor greater heating. It was even found that there was economy of fuel. The silencer can easily be placed in a suitable housing on the 'plane so that there will be no increase in head resistance."

This speaks in behalf of the airplane, with usually but 300 or 400 horsepower. One may well think of the airship—there is the ZRI of the Navy with six 300 h. p. engines—and its increase in volume of noise.

The requirements of a muffler may be summed up as follows:

There should be no objectionable loss of power. In tests of certain mufflers by the University of Michigan a loss of less than 1 per cent was shown.

There should be a saving of fuel.

Better cooling of cylinder walls should be obtained.

Cleanliness of spark plugs and valves.

Exhaust gas should be thoroughly cooled as it leaves to avoid the present danger of fire.

The muffler must be capable of being easily incorporated in the design of the aircraft.

The weight of the device should not be prohibitive. For 250 horsepower it should not weigh more than 20-25 pounds.

Shape must be favorable for the reduction of head resistance.

Quick detachability is desired.

The more rigid requirements of the aicraft muffler will when met, add much to the pleasure and economy of automobile transportation. An evidence of this benefit is furnished by the tests in 1915 of the University of Michigan in which some commercial automobile mufflers lost 14 to 18 per cent of the engine power. Such loss is expensive as well as needless.

In the matter of mufflers alone, it is evident that the automobile will again benefit by the airplane.

Those concerned in this work will be interested in Reports nos. 10 of 1916 and 55 of 1920, of the National Advisory Committee for Aeronautics, Washington, D. C., which reports cover the only work officially done in mufflers in this country, so far as is known. In these experiments a 75% reduction in exhaust noise was found certain of easy acquirement.

American Airplane With Change Speed Device

90 Mile Speed Range—Ceiling Increased Over Half—Climbing Speed Raised 31%—A New Era Promised

A device which will add 40 per cent to the high speed, reduce the landing speed by 26 per cent, add 51 per cent to the ceiling and cut 31 per cent from the time of climb to 15,000 feet of the standard airplane is the claim of an American in China, J. J. Dill, whose apparatus may be fitted to any ordinary machine and operates to change the angle of incidence of the wings, at will during flight from zero to 10 degrees.

A series of test flights have recently been made by a military pilot at Harbin of a machine fitted with the Dill device. At a fixed angle of 3½ degrees the average speed was about 94 miles an hour, with a Rhone 110 h. p. engine, despite the fact that the power plant was in bad order. In the second flight exceptional results were had with the device in operation. An altitude of 6560 feet was reached in 4 minutes with an angle of incidence of 6 degrees. During this flight the pilot changed the angle of incidence from 2 to 8 degrees. The corresponding speeds in horizontal flight at 2000 metres (6560 feet) with various angles of incidence, as shown by the speedometer, were as follows:

Angle of 8 degrees, speed 65.62 m. p. h.

Angle of 4 degrees, speed 90.62 m. p. h.

Angle of 2 degrees, speed 103.12 m. p. h.

"The alteration of the angle of incidence in no way affected the

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control of the rudders, and the variations did not make any pressure on the control stick; and the stability of the machine was in no way affected, having the same aeronautical qualities at the different angles," reads the pilot's report "The landing was easily made in the space of 82 feet with an angle of 6 degrees."

"The invention makes this airplane entirely different from any other I have flown, the difference being: (1) the short run required in starting and landing, (2) the rapid high climbing power, and, most important, (3) the different speeds obtained during horizontal flight, which can be changed at will in wide limits without any change of motive power.

"In my opinion the building of machines with high powered engines of 300 to 600 h. p. and more, and fitted with the Dill invention, will create a new era in aviation and make it possible to get the highest speeds, such as would be impossible without the invention, and with full load allow a machine to successfully take off and land."

The present day airplane, with fixed wings, may be compared with an automobile with powerful engine but with but one speed. An airplane of high horizontal speed must necessarily take off and land at comparatively high speed; and the machine with slow take off and landing is impracticable for military and high speed commercial purposes.

An airplane with a high climbing speed and capable of attaining a great altitude usually must have a powerful engine, or a high angle of incidence. In the first instance, it is expensive and in the second the 'plane must necessarily have a lower horizontal speed. In both cases, the machine has but one horizontal speed for any non-variable wing setting. To beat this situation, the changeable angle of incidence provides a radical solution.

The experiments, which are reported to have covered eight years, with official observation beginning in 1919 at Omsk under a Kolchak government commission and later at Harbin with another machine, are said to prove:

"By means of the Dill invention it is possible to alter during flight the angle of incidence of wings, smoothly and without any strain on the pilot.

"The alteration of the angles does not in any way affect the stability of the machine.

"The mechanism itself has an insignificant weight, and does not affect the strength of the machine.

"For the different angles the strength of the truss remains unimpaired."

The following comparison is made in the report of two airplanes of the same kind and characteristics:

Weight ....2400 lbs.
Power plant .....300 h.p.
Wing surface..280 sq. ft.
Profile ....RAF 15

In this instance one machine is supposed to have no adjustment for altering the angle of incidence and has a fixed angle of 2 degrees. The other is supposed to have the Dill invention attached by which the angle can be altered from 0 to 10 degrees during flight, at will. Comparing the two, a report by an observer of the test flights states the following figures:

SEE COPY FOR TABLE

With the first machine, a biplane 2-seater, with 110 Rhone, the 1919 tests results in the following performance:

Climb to 6560 ft. with full load 10.7 min.
Climb to 14,760 ft....... 48 min.
Take-off distance .. 197 ft. max.
Landing........... 295 ft. max
Speed at 8 deg....... 75 m. p. h.
Speed at 4 deg...... 875 m. p. h.
Speed at 0 deg..... 112.5 m. p. h.

The idea of changeable angle of incidence is not new but no practical device has yet been placed on the market. This scheme would be of inestimable value to the air flivver to which we are lookng but which manufacturers are reticent about producing this, and a reversible "prop."

TYPE	High Speed in m. p. h.	Low Speed m. p. h.	Ceiling feet	Time of Climb to 15,000 ft.
Dill machine	160.7	66.7	17,250	13.52
Ordinary machine	114.7	90.	26,080	19.72
Percentage	40%	26%	56%	31%

An American DH4 performance is cited below for purposes of comparison

DH4	124.0	61.5	17,600	40 min.

Flying in California

By R. J. Smith

TO those who are contemplating inaugurating an aerial transportation line and have sufficient money, backbone and ability with which to feed it during its infancy, the Pacific coast offers unlimited potentialities. On the other hand, individuals or small companies who are financially weak might more profitably go elsewhere, for California has already many such companies who are "just about making expenses" or, in the language of the individual "free lance," doing "not so good." At the time of writing, most of the last mentioned are "doing the small towns." Eastward, business as a "joy hop merchant" being slow in and around San Francisco, pilots without planes and jobs are plentiful here, too, although most of them, owing to the state law governing aircraft, hold state licenses.

The West today needs and is well able to support, reliable aerial transportation lines, which have, as before stated, sufficient money, backbone and ability behind them to be able to overcome all obstacles which might present themselves the first year, and present and maintain a regular service on schedule between certain cities here. The companies running these lines could safely start with large planes capable of carrying 10 or more passengers each, for in the writer's opinion the introduction and sight of these large aeroplanes would impress the public more favorably than a smaller model; in fact it is doubtful if the latter type would be

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favored at all. An instance might be quoted here as an example. Recently an organization inaugurated a flying company here in San Francisco. It was advertised that the planes owned by the company would maintain a schedule and fly between Los Angeles and San Francisco. The planes to be used were "Standards" with "Hisso" motors and some were converted to carry four or five passengers, I believe. I have a great respect for both this type of plane and engine, but venture to say that a "Standard" fitted with a "Hisso" motor is hardly a "five place job" or even a four. Needless to add, this company did not succeed here. But bring the large plane, put it on the same route, advertise extensively and sensibly, secure the services of an efficient personnel, a flying manager, one who will keep the planes in the air, let discipline be the company's slogan, and the spirit of esprit-de-corps prevail, and I feel positive success will be the reward. Then from San Francisco to points up the Sacramento River, sea planes or flying boats could be put into profitable service. One might ask how the public would take to it. Whether they would immediately or not is rather hard to say, but I think they would, especially the people of San Francisco. They would, I think, start the ball rolling and then the rest would follow suit. My reason for saying this is because the fliers of Crissy Field, both Air Mail and Army pilots have by their excellent flying shown the public here and for miles around that flying is safe in all weathers. These officers have much to be thanked for by commercial interests, for they have efficiently "paved the way." One sees perfect formations passing over the city and the bay almost every day. They fly at safe altitudes and sanely. I have often heard people remark, "How safe they always look up there." Also there are a good many who judge the time of day by when the mail plane goes out and comes in, so regular is the schedule.

The aeronautical organizations in the East would profit by investigating and taking advantage of the possibilities here.

San Francisco seems to be favored as an ideal city in which to hold conventions. Hundreds of thousands of business officials flock here yearly from all over the United States, and apart from one or two "joy hop" planes, there is no aircraft service to offer them. This year there were over 300,000 "Shriners" in town for their convention. The Army pilots gave them an exhibition of good flying. Capt. Yerex, the British R. A. F. pilot and another whose name I do not know, flew over the town at night giving acrobatic flying displays in an illuminated plane throwing fire, but nothing serious was done in the way of sight-seeing trips. In fact, I think I can safely say not more than 50 (if that) even flew out of the whole 300,000. Let us assume that there had been an organization operating large planes here at the time. They would have reaped a small fortune in sight-seeing trips alone. Another point worth considering is the fact that these Shriners came from all corners of the country and are now "back home" talking about all the excitement they had here. The same thing happens when the men taking part in future conventions return to their home town. An aerial transportation line would therefore receive much invaluable publicity.

The aeroplane is by no means a "new mystery" here. The public have been partially educated that flying is a safe mode of travel and it is good to note that although much flying has been done, accidents, even of the smallest nature, have been very few and even these have mostly, if not all, been due to stunt flying or taking unnecessary risks. The state law forbidding pilots to fly without licenses has, I think, improved matters considerably here. Local interest in San Francisco would, I should say, support an aerial transportation line if approached in a tactful and businesslike way, until the line's development permitted it to be independent of any one source of revenue. Business generally is good here and where business is good so should flying be.

Let us now consider the weather and the characteristics of the ground along certain routes. Unfortunately I have not much data on the latter but this might be easily ascertained from the regular maps and from various other sources. I might say, however, that most of California is good, and although the state is mountainous only a few need be crossed to reach any point. There is generally a fog hanging over San Francisco Bay territory, but if one knows the bay and is careful this is not a serious drawback. The uneven character of the ground makes the air at low altitudes bumpy at times, but taking all in all, it's not a bad old state to fly over, from the pilot's point of view. One can judge the physical hazards here fairly well by reading the description of California in an article entitled "Information for Pilots, Giving the Practical Characteristics of the Land Along Various Routes," which is in the October 10, 1921 issue of Aerial Age.

This article gives but an outline of what might be here, and in fact what can be expected in the not very distant future. Much more could be said, but this outline may be of interest to those who read it. It may receive criticism. I hope it does, for that will prove interest, and if my critics will send in their various opinions to Aerial Age I have no doubt that the Editor would compile the data received and publish another article which would be based on the facts sent in this way, for such an article would, I feel, be very interesting and helpful to aeronautical interests.

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AERIAL AGE

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Detroit

AERONAUTIC history was written at Detroit, and records that are likely to stand for some time were established. Aeronautic enthusiasts rejoice that all of the contests staged were carried through without injury to any of the participants, a very remarkable event when one bears in mind the extraordinary speed which some of the machines attained.

The Curtiss Company created an enviable record by having its four machines take the first four places in the Pulitzer, a worthy testimonial to the efficiency of the Curtiss CD-12 engine, which is completely described in this issue.

Everyone concerned with the management of the Detroit events have every reason to be thoroughly satisfied with the outcome of their efforts.

National Aeronautic Association

The developments which will follow the organization of the National Aeronautic Association are being associated with interest by all interested in the advancement of American Aeronautics. There is much constructive work that requires to be done, and it is to be hoped that this new body will get down to business and endeavor to rehabilitate the sporting and social side of aeronautics, which, at the present, requires much rehabilitation. Details of the formation of the association reached us too late for inclusion in the November issue, but we hope to deal fully with the subject in our December issue.

A Woman Crosses the Continent

To Miss Lillian Gatlin goes the honor and distinction of being the first woman to cross the American Continent by the air route. She was consigned by air mail in San Francisco with her destination New York, which she made successfully after triumphal receptions at all the stops on the way. As a result of her flight millions of Americans had their attention focussed on the air mail and the wonderful work being done by it daily, and we are indebted to Miss Gatlin for her courage and enthusiasm in seeing it through.

We are getting so used to saying that America is far behind in the development of civil aviation, that we frequently fail to give proper attention to the achievements which have been made. The figures recently published concerning the past twelve months of aerial mail service give a striking record of accomplishment.

The entire aeronautic industry has been conscious of the presence of this service but its real scope and accomplishments are scarcely recognized. The figures given are for the fiscal year ending July 1, 1922.

The planes in mail service covered 1,750,000 miles and carried 49,000,000 letters. This mail totaled 1,224,500 pounds.

92.5 per cent of the trips scheduled were actually completed and 94 per cent of the scheduled mileage was actually flown. This is a record for reliability to which any commercial transportation medium might point with pride.

The air mail service is of interest to the aeronautic industry, chiefly as an experimental route of civil aviation. Its record for the past year indicates the regularity and safety with which a service of this kind can be operated in the United States, given proper organization and careful supervision.

The German Sailplanes

THE achievement of HENTZEN in the glider Vampire in the hills near Wiesbaden—he remained aloft two hours and ten seconds—amazed the professional aviators. And well it might. They knew that the gliding machines of the WRIGHT brothers could not be kept in the air for more than seconds, and that not until a petrol motor was installed in 1903 was there a flight of as much as fifty-nine seconds. Two years were to pass before their plane remained aloft for half an hour and was driven twenty-four and a half miles. At Wasserkuppe, in the Rhön hills, HENTZEN in the Vampire, with no motor to whirl a propeller, contrived to stay up four times as long as one of the WRIGHTS did in 1905, and at the end HENTZEN glided a distance of ten kilometers, a little more than six miles, before landing. What was accomplished with the motorless flying machines in the recent Clermont-Ferrand competitions seems insignificant by comparison. The French aviator BOSSOUTROT succeeded only in "flying" two minutes and fifty-one seconds in a Farman monoplane.

The reason for the German superiority cannot be found alone in favoring winds that blew "from seventeen to twenty miles an hour, with occasional thirty-mile gusts." The French competitors had wind enough, fifteen miles an hour and more. It is evident that the Hanover Institute of Technology, where the German gliders are made, has evolved important combinations of planes or wings and operating levers.

It seems to be fundamental that in calm air such feats as those of the Germans would have been impossible. Wind was required: the more the better, short of a gale. If a light motor were installed in their "gliders," ascents could be made and actual flights effected in a calm. Sailplane, as the Germans call the Vampire, seems to be an appropriate name.

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The Aeronautic Situation in Italy

By WILLIAM KNIGHT, M. E.

ONE of the European Countries which has contributed the most to the development of Aeronautics both as science and as a branch of Engineering is Italy.

Italy is one of the few countries that can boast of having made a real and lasting contribution to the development of aeronautical research work and to the realization of some of the best airplanes and seaplanes which have been designed so far.

In dirigible construction, Italy is competing with Germany and the performance of the Italian semi-rigid type during the war has conclusively proved the many advantages offered by this type of dirigible construction as compared to the rigid-type.

Italy has exceptionally good technical men like Col. Crocco, Col. Costangi, Col. Riccaldoni, Prof. Anastasio, Prof. Panetti, Col. Guidoni, etc., and designing engineers like Rosatelli, Conflenti, Tonini, Marchetti, Forlanini, Cappa, etc. Italy has trained during the war five-hundred thousand men in the aircraft manufacturing industry and when the war stopped the Aeronautical manufacturing industry in that Country had progressed to a considerable extent and it was readily admitted that Italy would prove to be a dangerous competitor for the aircraft manufacturing industry of neighboring nations.

In spite of all this, Italy is to-day the only great nation in Europe which has no commercial aviation, no programs for the near future, and a Government, which judging from the results, or rather from the lack of results takes no interest at all in either commercial or military aeronautics.

In a note published by Col. Tuz. G. Costanzi on *post bellum* aviation in Italy, the author who during the war and after the armistice was the representative of the Italian Air Service to the Supreme War Council in Versailles and also technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris, puts squarely the responsibility for such a state of affairs where it belongs.

Immediately after the armistice was signed, while in France, Belgium, England, Germany and Holland every effort was made for keeping alive the aircraft manufacturing industry and for developing gradually the transformation of military into commercial aviation, in Italy a process of liquidation of all aeronautical activities was started by the government and whatever was left of the war-time organization of aeronautical services, kept on changing names and shifting from one department to another.

In spite, however, of the lack of encouragement on the part of the government, and, what is worse, in spite of the handicap placed on the aircraft manufacturing industry by the lack of an aeronautical governmental policy, aircraft manufacturers, or at least the most courageous ones have succeeded in maintaining the high standard of Italian aircraft abroad where they are exported in large numbers and where they are duly appreciated.

It is not comprehensible however, when we look at the map of Europe crossed all over by English, French, Belgian, German, Swiss, Rumanian and even Russian aerial lines that Italy is the only European nation which is not bankrupt and yet does not find it worth while to develop aviation.

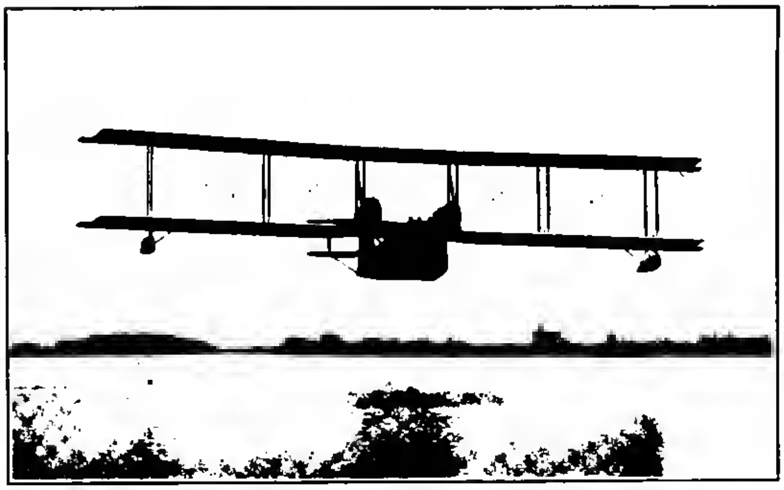
The British press has repeatedly announced the organization in the near future of a large aerial transportation company operating between England, Egypt and the Eastern part of Europe. This company will be formed, it seems, with British capital and for the purpose of furthering British interests in the Orient.

The Italian press has repeatedly pleaded with the Italian Government for the protection of Italian Aeronautical interests in connection with the operation of international lines. If it is true that foreign aerial companies are going to be operated in Italy without any participation of Italian capital and without any reciprocity of advantages being stipulated for between the Italian and foreign governments, the hint conveyed in the Italian press to the Italian Foreign Office to consider aeronautics as an international issue and not as a local matter is probably justified.

At any rate we sincerely hope that something will be done in the near future for starting commercial aeronautical activities in Italy with the co-operation of the Government, aircraft manufacturers and Italian capital.

Aeronautics needs the co-operation of every nation and the good will of the people of the world in order to develop into a means of bringing together the citizens of all nations for the peaceful pursuit of their commercial interests. It would be a bad policy to establish over any nation the aeronautical supremacy of another country. It would not be conducive of good feelings in the long run and it would defeat the main purpose of aeronautics which is the international commerce in the interest of all nations.

We need co-operation in Aeronautics, we do not need individual supremacy in the air by any nation.



The Pogna-Rossi-Bastianelli flying boat equipped with four Isota-Fraschini engines.

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THE NEWS of THE MONTH

Hartford Aviation Meet

Fourteen events, calculated to demonstrate the advance in aircraft design, construction and operation during the past year, make up the Armistice Day program for Hartford's second annual Aviation Meet. City officials in charge of the municipal airport are assisting the local Aero Club to make the enterprise surpass anything of the kind heretofore staged in New England. Enthusiastic participation has been promised by the War, Navy and Post Office Departments, and liberal inducements, including free hospitality and supplies, have been offered aircraft manufacturers and operators to take part.

All participants are to arrive in Hartford and register during the afternoon of Friday, November 10. The formal program will he carried out next day, when the industrial establishments generally will close down on account of Armistice Day. Sunday will be available for passenger carrying by all who may choose to engage therein. Lieutenant Samuel T. Mills of the U. S. Air Service will be in direct charge throughout the same as last year.

"Stunt flying" will be prohibited throughout the entire meet, but liberal prizes are offered in connection with the following features: (1) Largest number of planes sent by individual, aero club or manufacturer; (2) Largest delegation sent by a Goverment Station; (3) Most popular plane as designated by vote of spectators; (4) Greatest mileage flown direct to Hartford; (5) Free-for-all race 45 miles triangular course; (6) Class A race for planes rated up to 125 miles per hour; (7) Class B race for planes rated up to 100 miles; (8) Altitude contest unlimited; (9) Fifteen minute altitude contest; (10) Accuracy landing from 1500 feet; (11) Free-for-all seaplane race to Springfield and return; (12) Relay race—each team to comprise two Class A and two Class B ships; (13) Bomb dropping from 500 feet; (14) Bursting toy baloons.

Announcements of the meet sent out by H. Terry Morrison, Chairman of the Flying Committee, are particularly designed to interest and aid visiting pilots. They show a general map of Hartford and vicinity covering all features of the municipal airport, and an airscape of same from 1500 feet elevation with the city as the background. Funds appropriated by the city to relieve un-employment last spring, were expended in smoothing the surface of the 100 acre landing field, until "best in the country" has become the general verdict of visiting aviators.

248 Miles an Hour

Travelling at a greater speed than any human being ever before attained, Lieut. R. L. Maughan, a United States Army pilot, on October 16 at Mt. Clemens, Mich., set a new world's airplane speed record by covering a one-kilometre course at the rate of 248.5 miles an hour.

The record was made during official Government tests of speed planes that participated in the national air races at Selfridge Field and was electrically timed by officers from McCook Field.

Aeronautical engineers and army and navy officers who witnessed the flight were astounded. The demonstration, they declared, proved that there is no limit to the speed that might be attained in the air.

Lieut. Maughan made the record-breaking flight in the same plane with which he won the Pulitzer trophy race on Saturday. The machine is a Curtiss army biplane, powered with a Curtiss 400-horse power engine.

After setting the new record, Lieut. Maughan continued his flight to show that the tremendous pace could be maintained. On four laps he was timed at the rate of 232.22 miles an hour, and his average for eight laps was 229 miles an hour.

Examination of the machine after the flight disclosed that it was in perfect condition and that nothing in the nature of a trick flight figured in the record performance.

Later Lieut. Maughan added to the astonishment of pilots and officials on the field by flying approximately one mile with the machine on its side. The feat in reality was a flight without the aid of wings. In other trials during the day the speed record for monoplanes was shattered by one navy and three army machines.

Lieut. Barksdale covered the one kilometre course at the rate of 191 miles an hour, and Lieut. Whitehead made 187. They drove Loening-Packard planes. Capt. Hunter, in a Thomas Morse, was timed at 179 miles an hour and Lieut. Calloway, in the navy's bee line racer, made 177.

The trials will determine, to a large extent, the type of machines to be developed for the army and navy. Maughan's flight was said to have made it virtually certain the army would select the Curtiss-Army biplane as the standard pursuit type.

Navy Tries Out Balloons to Be Towed by Warship

Successful test of a new dirigible balloon, designed, it was said, to replace the captive observation balloons of the World War, was conducted at Wilbur Wright Field, October 14, by Charles Branningan, test pilot, of Akron, and Ensign Charles Bauch, United States Navy.

Under the test the balloon arose 500 feet in the air and was attached to a motor truck. It was pulled to various points on the field, then cut loose, and under its own power cruised about, coming back to the truck, where a drag rope was picked up and the ship towed back to its mooring.

It was pointed out that the balloon might be towed astern a hattleship and, after cruising ahout for observation, might again be attached to the ship. The new ship, slightly larger than a pony blimp, is ninety-five feet in length and is driven by a single motor. It eventually will be assigned to some navy aviation field, it was said.

French Flyers Fail to Equal U. S. Mark

The French aviators, Lieutenant Boussoutrot and M. Drouhin, who ascended in a Goliath biplane in an attempt to beat the American duration flight recently made at San Diego, Calif., by Lieutenant John A. Macready and Oakley Kelly, landed after having remained in the air 34 hours, 14 minutes and 32 seconds. They thus failed to equal the record of Macready and Kelly, which was 35 hours, 16 minutes and 30 seconds.

The French Aerial Federation, however, considers the mark set by

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Bossoutrot and Drouhin an official world's record, contending that the American flight was conducted under such conditions as will not be accepted by the international federation, of which the United States is a member.

"I have been to America and half way back again," Bossoutrot said on alighting from the plane, wrapped up in heavy furs. The aviators were forced to land through lack of gasoline, of which they had taken 4,200 litres when they started.

The Goliath traveled 3,200 miles, according to the instruments, which were sealed before the departure. It always kept within sight of the walls of Paris and was in constant communication by wireless with the Le Bourget.

National Aeronautic Association

The recognition of the need of a truly representative national body to advance American aeronautics led to the formation of a Joint Committee in 1921 representing the Aero Club of America and the National Air Association, with Howard E. Coffin, of Detroit, as Chairman. This Committee decided upon an Aero Congress at which should be formed the National Aeronautic Association.

Temporary offices were established in Washington and in Detroit and the date of the Congress set coincident with the National Airplane Races in Detroit, October 12 to 14th, 1922. An Advance Committee on Organization, composed of five hundred leading aeronautic enthusiasts, was formed and of this body an Executive Committee of thirty was appointed. Upon the suggestions and advice of these committees the Second National Aero Congress was held.

More than four hundred delegates representative of many states, cities civic organizations and aero clubs and various aeronautic interests, responded to the call of these committees. By-laws were adopted, officers and governors elected, and National Headquarters established in Washington. The new Association was incorporated October 14th, 1922, as a non-profit membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane, and incorporation completed on the day of adjournment of the Congress.

Officers elected were as follows: Howard E. Coffin, President; Bernard H. Mulvihill, Vice-President; Benjamin F. Castle, Treasurer; John B. Coleman, Recording Secretary.

Governors elected, two from each district, were as follows: 1st District: Porter Adams, Godfrey Cabot; 2nd District: John Larkin, Jr., Maurice Cleary; 3rd District: L. F. Sevier, R. J. Walters; 4th District: Van H. Burgin, L. Sevier; 5th District: Glenn L. Martin, Dudley M. Outcalt; 6th Disttrict: C. S. Dieman, Sidney D. Waldon; 7th District: Ralph Cram, H. F. Wehrle; 8th District: Edgar G. Tobin, William F. Long ; 9th District: P. G. Johnston, C. H. Messer.

In addition, by the provisions of the by-laws adopted, five Governors-at-large are also to be elected by the Governors mentioned above. Such election will take place shortly as will also the appointment of an Executive Committee of the Board of Governors, authorized by the By-laws.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics;

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be collected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique Internationale all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

Arlington Radio Station

The installation of a recording wind vane, anemometer, and sunshine recorder on the 600-foot radio tower at Arlington, Va., has been completed, and information concerning current wind conditions is now available to aviators. Data may be obtained by calling phone Washington "West 81" and asking for "Aerological data."

2. The following information of value to aviators is hereby made available:

(*a*) Current wind direction and velocity can be obtained instantly at all times and in any weather at an altitude of approximately 785 feet above sea level (600 feet above the surface at Washington).

(*b*) An indication of the thickness and probable duration of fog and low-lying clouds at Washington is given by the record of sunshine at the top of the tower.

The De Haviland 4a with Rolls Royce engine which won the King's Cup Race in Great Britain. Piloted by Capt. F. L. Barnard

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Aerial Mail Performance

Ten weeks of 100 percent performance on all three divisions of the trans-continental air mail service will have to stand as the record for awhile. A radio from Iowa City reporting a default on account of bad weather ended the longest period of perfect flying the air mail has made.

From the second week in July through the third week in September every air mail plane left its field according to schedule and the mail was carried the entire way to the destination by air. Each plane carries from 400 to 500 pounds of mail containing approximately 20,000 letters on each trip.

For the last year 92 percent performance was made by the air mail. Fortified by the excellent record of this summer, it is hoped that this year's performance report will be even better.

The Goodyear Semi-Rigid Dirigible

In building its first semi-rigid airship, America will have the aid of Umberto Nobile, distinguished Italian engineer and co-inventor of the demi-rigid type of lighter-than-air ships.

Engineer Nobile, to give him his official title, is managing director of the Italian government aircraft factory near Rome, and comes to America about October 1st on a three month's leave of absence, to assist in the calculation for building the 300 foot semi-rigid airship for the U S Army now under way at the Goodyear Aeronautic factory.

The semi-rigid type of ship originated in Italy just as the rigid or Zeppelin type originated in Germany and Engineer Nobile is the foremost authority on this type of ship in Italy, and consequently in the world.

In engaging him to come to America, The Goodyear Tire & Rubber Company which has the contract for building the huge craft, wanted to take every possible precaution of safety and Engineer Nobile will personally calculate all the stresses that a semi-rigid is subject to during flight or when moored out in the open.

Engineer Nobile has just completed the designs for a new semi-rigid ship for the Italian government, only slightly smaller than the one being built for the American Army, and expects to get back in his own factory by the time construction is under way, so he can supervise that work.

The projected American ship, also called a "mother" airship, since it can be used as an airplane carrier, will be as long as a city block and its great gas bag will have a capacity of 750,000 cubic feet. An idea of its size can be had from the fact that the largest non-rigid ships built in this country have a capacity of 180,000 cubic feet of gas, though some 203,000 cubic feet helium ships will be built next year.

It will have a speed of 70 miles per hour and a cruising radius of more than 4000 miles and will be able to pick up and release airplanes while flying at full speed.

The distinguishing feature of the semi-rigid ship is its metal keel running the length of the 300 foot gas bag. The power cars containing engines and propellers and the navigator's car are to be suspended from this metal keel, while the huge gas bag will be attached to it at intervals of 10 feet.

It will be the largest semi-rigid ship in the world when it is completed the only larger American airship being the rigid ship ZR-1 now being built by the U S Navy at Lakehurst N. J. and at Akron. The rigid ship will be 630 feet long and have a series of gas compartments or ballonets, with a total gas capacity of about two and a quarter million feet.

Both airships are to be completed next fall, and will enable the American government to test out the relative usefulness of the two types.

Aerial Photography Progressive

"The aerial camera is taking an economical and highly important part in the reconstruction of the devastated areas of France and in the restoration of the arid regions of Egypt and Mesopotamia, which in ancient times were the centers of civilization," said Sherman M. Fairchild, a Governor of the Aeronautical Chamber of Commerce, and President of the Fairchild Aerial Camera Corp. on his return from Europe.

"It is stimulating to learn that America leads the major European nations in the scientific development of aerial photography, but in the practical application of the art on a national scale we must look to France as the leader. The French, since the ending of the war with Germany, have systematically set about the development of aeronautics through utilization of every service offered.

"Shortly after the Versailles treaty was signed, a French law was passed requiring every city in the republic, above a certain size, to be resurveyed within three years. It would have been physically impossible and financially impracticable to accomplish this by ground methods. The result was that mapping by air was adopted throughout and one company alone surveyed 200 cities from airplanes.

"Aerial mapping is being extensively used by the Ministry of Liberated Povinces. The areas of France devasted during the war are being resurveyed from the air, as in many cases not only were property lines obliterated, but the records of entire communities destroyed.

"The City of Paris was mapped from the air to a scale of 200 feet to the inch, thus making it possible to identify even small buildings. Corrections, such as new structures, streets, etc., were printed in red over the existing maps. For this air mapping work the French company received the equivalent of $400,000."

Mr. Fairchild believes that a rich field for development in aerial photography awaits American companies entering Central and South America, and such European countries as Spain, Greece, etc.

L. W. F. Giant Bomber Successful in Trial Flights

The giant bombing airplane "Owl" designed and built by the L-W-F Engineering Co. Inc., College Point, N. Y. and known as their Model H-1 was successfully test flown on Saturday 16th inst. The machine is a redesign of the original "Owl" which was wrecked at Langley Field, Va. in 1921 and much of the original

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structure was salvaged. It will be remembered that the first "Owl" was a mail carrier but taken over by the Army service. It proved safe and airworthy but entirely unsuited to military requirements. While proceeding with the repair work the L-W-F. Engineers submitted designs to the Engineering Division showing a complete revision of type and suiting the machine to all requirements for a bomber of the latest class which were favorably received and authority given to proceed with the new design.

The "Owl" as redesigned has a crew arrangement somewhat similar to that proposed under the Army specification for Type XIII. Two pilots are seated in a central nacelle slightly forward of the front spar. The controls are dual or equally accessible to either man and double control wires are used throughout. A bomber's cockpit is located below and slightly ahead of the pilots. Sign communication so important in this type is very convenient. The bomber has vision slightly above the horizontal in approach and about a 15 degree trail angle and can see the nose of his bomb at all times. A rear gunners cockpit is provided in the after part of the same nacelle. A double Lewis gun on a scarff mount commands the entire upper hemisphere with a good part of the lower. In addition a remote control Lewis floor gun is provided for the defense of the lower hemisphere. Provision is made for the mounting of a forward gun but this has been omitted as inconvenient for use while the dual control is in use. A crew of four is therefore required but provision is made to accomodate four additional men in the center of this nacelle if so desired.

All fuel is carried in the two fuselages miminizing danger to the crew in case of a crash. Sufficient for over five hours at high speed is carried. A "Pyrene" sprinkler system working under pressure is installed in each motor compartment. The motor controls are very interesting and were designed by the L-W-F company known as the "Arens" control. These will be described in a later issue. A carrier for a 4000 lb. bomb is mounted directly under the lower wing. Two 2000 lb. bombs may be carried with equal convenience by mounting two additional carriers. L-W-F type monocoque construction is used for fuselages and nacelle. The weight fully loaded is given as 18,000 lbs. and 22,000 lbs. with the bomb load. The span is 106 feet and a U. S. A. type No. 6 wing curve is used. Three Liberty 12 engines are used. A speed of 106 m.p.h. has been obtained in the trials.

The trials took place at Mitchell Field. Lt. Melville was the pilot and took with him on the initial test Donald R. Black designer F. W. LaVista and Chas. Arens of the L-W-F Company. The machine was taken off after a very short run and flown for half an hour. A perfect "three point" landing was made ending the run within a few feet of the point desired. A second flight was made immediately after and a full crew of passengers taken up. Lt. Melville pronounced the machine as entirely satisfactory and a decided improvement over the original. General Patrick made an inspection tour of Mitchell Field and was taken for a trip in the "Owl". He expressed great satisfaction at the apparent ease of control.

Airplane Landing Field Layout

The September 28th issue of the Engineering News-Record contained an illustrated article on the arrangement and construction of airplane landing fields, written by Archibald Black. This paper—probably the first really constructive discussion of the subject published—takes up the problem from the viewpoint of the municipal engineer.

In an editorial commenting upon the article, which appeared in the same issue, the significant suggestion is made that landing field activities may extend the field of work of the municipal engineer.

Mr. Black's paper takes up and discusses in detail each of the important points to be considered. Illustrations of possible field arrangements and of an ideal field layout are given. A novel method of layout is proposed to provide for the future expansion as the size of airplanes increases. This consists of arranging the building area into plots of 200 by 200 feet, thus permitting the erection of ultimate hangars of 200 by 200 feet should the size of future airplanes warrant this. A composite building plan is included to show that the proposed large plot can be used to full advantage for the smaller sizes of buildings in the meantime.

The size and type of runways are discussed together with recommendations for their construction. The important questions of drainage and field surfacing are considered. As there appears to be a quite general impression that grass is merely "grass", it may be news to many to learn that no less than *eight* different types of grass seed should be blended to ensure the raising of proper turf.

International location markers and field markers are described and suggestions made for their construction. In closing, the author devotes some space to a general discussion of water, power, transportation and similar facilities.

The L-W-F Owl Which Was Recently Flight Tested Successfully

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Airplane Forest Patrol Commended

The excellent work performed by the detachment of the 91st Squadron (Observation), stationed at Eugene, Oregon, in connection with the aerial patrol of the Oregon forests, has occasioned much favorable comment from all sides. The following letters addressed to Captain Lowell H. Smith, in command of the detachment, tend to show the attitude of others than those immediately connected with the Air Service towards the patrol of the forests by airplanes.

A letter from the Douglas County Fire Patrol Association is as follows:

"This association has found the new system of patrolling as maintained this season to be extremely satisfactory. We believe that from our standpoint the maximum amount of good can be accomplished by the Air Service patrol as maintained this season. It affords us a much better chance of combating fires after they are located, in determining what steps to take. Taking it as a whole the service has been very satisfactory.

The patrol as maintained has also been very beneficial in making the ground force more efficient, as the men on the fires know that we have a personal supervision of their work and can tell whether or not they are using the greatest amount of effort. It also has a good moral effect on campers, tourists and stock men. We find the ranchers more reluctant in setting slashing fires without permits and the hunters and fishermen have their attention called to the fire hazard by seeing the airplanes flying over the territory in which they are located."

The following communication is from the Booth Kelly Lumber Co.:

"There has been some discussion regarding the value of the air patrol in forest fire protective work. During the present dry season, because of smoke blowing in from the north, which is the general rule and not the exception, look-out stations have been practically of no value and the vision of the patrolmen has been very limited. Observers in your ships have been able to detect fires which would not have been discovered in any other way until they had gained considerable headway. In scouting over large fires they are able to give information to fire-fighting crews which cannot be gained as quickly or as accurately in any other manner.

It would seem that the results accomplished this year would convince the most skeptical and that should the Department at Washington know the true value of this work there would be no uncertainty regarding the future yearly patrol.

We wish to extend to you and through you to the others in your organization our high appreciation of the courteous and efficient service given our association the present season."

Captive Helicopters May Displace Observation Balloons

"Well, here it is, what good is it?" said an aeronautical engineer as he watched the successful flight of the Berliner helicopter.

"What good is a new born child?" was the retort of an army officer not unfavorably known for good ideas and initiative. "It's got to grow and make a place for itself."

The helicopter idea is as old as the airplane. Some had the idea that it could be put to practical use not only in war but in peace time. The German empire must have had some ideas when it started official work on a captive helicopter in 1916. There is still open the British prize of £50,000 for a practical device.

What might not be possible in war, say, with a little frame, an armored box for the observer, and electric motor and propellers, driven up to any desired height through electric current from the ground and held captive. Might it replace the bulky and comparatively unwieldy kite balloon. The helicopter claims the advantage of low perceptibility and therefore a small target for artillery, armament against enemy aircraft, especially good field of fire overhead, incombustibility, rapid movement of its position.

An Austrian balloon company on the front with 1 balloon required 1 automobile winch car, 2 gas cars, 3 auto trucks, 6 officers and 137 men. The hell-bent-for-helicopterists claim that the common or garden variety of helicopter needs but 2 trucks, 3 trailers, 6 officers and but 20 men.

The Navy would find use for it on board ship, where the necessity for altitude is not so great as with land forces. For home defense, for searchlight mounts and for detection of enemy aircraft at far distances. An unmanned helicopter carrying recording instruments could be used in any kind of weather by the Weather Bureau or meteorological section of an air service. It might, unmanned, be used for radio where heavy masts are out of the question.

The thought of a captive power-driven aircraft is novel, to say the least. The use of a gasoline engine to take it from place to place might do away with the automobile trucks for transportation of an electric machine.

However, speculation as to achievement of actual sustentation of the airplane. Some had the idea that it past. The Berliner helicopter actually sustained itself.

New Navy Training Plane

A new type of training plane for the training of student naval aviators which combines safety features, never before equalled in aircraft, with qualities of speed and maneuverability has just been delivered at the Naval Air Station, Anacostia, after a flight of seven hundred and sixty miles from Ogdensburg, N. Y. The plane was flown from Ogdens-

The Army blimp which made a cross-country flight from Ross Field, Va. to Arcadia Field, Cal.

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burg to Washington in ten hours flying time by Commander T. G. Ellyson, of the Bureau of Aeronautics, accompanied by G. B. Post a representative of the builders.

The plane will be known as the Huff-Navy, HN-1, and was built to Navy specifications by the Huff-Daland Company of Ogdensburg. Tests conducted at the factory and subsequent flights notably the one from New York have demonstrated excellent qualities of stability in the plane which renders it of exceptional value for training purposes.

A recent demonstration conducted by a Navy pilot under the supervision of naval inspectors showed that the HN plane was all but capable of flying without a pilot. A description of the test by Commander Ellyson is sufficient to give an accurate idea of the stability demonstrated by the plane. "In testing the plane for stability the pilot released the controls, taking his hands and feet off them. The throttle was cut to low speed and the plane went into a long glide. He then speeded up the engine and still without the controls being touched the plane leveled off and continued in normal flight with the engine turning up from 1100 to 1200 revolutions and the plane making about 60 knots. Finally the engine was speeded up with the throttle wide open. The plane began to climb and in doing so her speed was cut to about 40 knots. She fell off on one wing and dove until a speed of 100 knots was registered when the plane again leveled off in normal flight. During the entire demonstration, the Pilot, Lieut. Nielson, did not touch the control with either his feet or his hands."

The HN is equipped with a Wright engine built by the Wright Aeronautical Corporation. This is the engine which recently passed a record breaking test of 250 hours duration on a Navy test stand in Washington.

Lighthouse For Navy Pilots

A special light for air stations has been put into operation at the Naval Air Station at Hampton Roads, Va. This is a 6000 candle power white light, flashing every three and one third seconds. It has an elevation of 65 feet above mean high water and is visible 20 miles horizontally. The rays from this light diminish in intensity towards the zenith. This feature of construction is necessary in order that an approaching aviator will not be blinded by the upper rays when close to the light.

This aerial beacon is operated by acetylene and functions automatically. It is controlled by a "sun valve," which works on the thermostatic principle. During daylight hours the valve is expanded by absorbed light rays and the main light is extinguished. After dark the valve contracts and allows the light to start functioning. A small pilot light is kept burning continuously for the purpose of lighting the main flame.

The object of this light is as a guide to aerial observation and to aid in locating the Naval Air Station.

Rapid San Antonio-New Orleans Flight

Captain W. P. Hayes and Master Sergeant C. W. Kolinsky of the 90th Squadron, stationed at Kelly Field, San Antonio, Texas, recently made a test flight to New Orleans, La., with a remodeled DH 4 airplane. They left Kelly Field at 6.15 a.m. and made the 560 miles to New Orleans in four hours and thirty minutes flying time, or at the rate of slightly over 124 miles an hour. One had only to do this trip by train at a temperature of 94 in the shade to become an enthusiastic exponent of aviation.

Captain Hayes reports that, although the field at New Orleans was supposed to be in good condition, well soded, he found the grass about eight feet high. However, after negotiating a landing, it required four mules and eight men to get the ship out. The mules were furnished by the Park Department in preference to cutting the grass. Captain Hayes reports that every courtesy was shown by the city authorities and various civic organizations. They stated, in explaining the condition of the field, that Captain Hayes' ship was the first one to stop at New Orleans for some months. It would therefore seem advisable to encourage the municipal landing fields by more frequent flights.

Investigating Landing Fields.

Lieutenant C. H. Howard, Air Service, recently returned from a fifteen hundred mile cross-country trip into Maine and Vermont, where he marked emergency landing fields and selected five large tracts of land which will be suitable for use in concentrating large divisions of the Air Force in case of emergency.

Lieutenant Samuel M. Connell, Air Service, performed a similar mission through Northern New York, Connecticut and New Hampshire, traveling 1200 miles. He marked all emergency fields and located six large tracts of land near certain of the larger towns of New York State where encampments could most easily be located in time of emergency.

Flight Surgeons' School Opens

The Medical Research Laboratory and School for Flight Surgeons at Mitchell Field, L. I., New York, opened its fall term recently with a class of twenty students in attendance, twelve of whom are Naval officers and eight Medical officers of the Army. They will remain at Mitchell Field for a three month's course, upon completion of which they will be returned to their original stations for duty as Flight Surgeons, either in the Army, Navy, or Marine Corps.

Navy TS and TR Planes

The TS-1 airplane represents the original development of the TS type and this design was prepared under Commander Hunsaker's direction to fulfill the need for a reasonably high speed combination land and seaplane single-seater fighter biplane ostensibly for use with the fleet. The type has been designed for catapulting as a seaplane from battleships and can also be launched as a land plane from an aircraft carrier.

The development of the TS type represents a distinct advance in airplane design and embodies several noteworthy features.

Wood and fabric construction is used throughout, except for struts, which are of steel. Few wires are used for external bracing, steel tubes being substituted to facilitate rapid assembly and take down, and to reduce head resistance. The upper wing is one unit and is but 25 feet in length. The lower wing comprises a center section and one outboard panel on each side. All wing and strut attachments are effected by single bolts and adjustment is provided for struts where necessary.

The overall height of this airplane has been made a minimum by placing the fuselage above the lower wing and allowing minimum clearance of the propeller above the water. Twin floats are employed, only four supporting struts being used for each pontoon and only two longitudinal bracing wires.

A noteworthy feature in the fuel system is the location of the gasoline tank, which is placed in the center section of the lower wing, provision being made to release this tank in flight in case of emergency.

The TS type is probably 25% smaller, hence more compact, than any other comparable plane known.

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and this achievement has been reached by the application of the resuits of recent scientific develop ment on wing, tail, and control surfaces, combined with an original general arrangement and special attention to the general and detail structural features.

It has been a gratifying result in the development of this design that the actual weight of the finished product fell within a few pounds of the calculated weight, and the high speed actually developed resulted about 2% higher than that predicted.

The modifications of the TS, such as the TS-2, TR-1, and TR-3, are experimental types constructed for comparative purposes, using different engines and wings.

The TS-1 was designed around the Lawrance radial air-cooled engine rated at 200 horse-power. The TS-2 employs an Aeromarine eight-cylinder, water-cooled engine. The TS-1 and TS-2 afford a direct comparison between the two types of engines; no actual flights, however, have been made with the TS-2.

The TR-1 and TR-3 types are practically the same as the TS-1, except that the wing section employed is different, it being intended to develop a faster modification of the TS-1 for experimental purposes. Here again a comparison between air and water-cooled engines is contemplated, as the TR-1 employs the Lawrance engine and the TR-3 the Wright Model E-3 water-cooled engine. All these engines develop the same horse-power on the block.

While these seaplanes were not designed for racing purposes, the advantages afforded of entering them in the Detroit Races have been taken, as the experimental results derived from racing in general are extremely valuable and, of course, a racing prospect always stimulates production.

Characteristics and Performances

	TS—1	TS—2	TR—1	TR—3
Span	25′ 0″	do	do	do
Length	24′ 7″	do	do	do
	Lawrance	Aeromarine	Lawrance	Wright
Engine	J—1	U—8—D	J—1	E—3
Horsepower	240	240	240	240
Weight, empty	1345	1407	1345	1570
Useful load	500	500	500	500
Total weight	1845	1907	1845	2070
High speed (mph)	124*	127	136	140
Climb in 10 minutes	13000	12000	13000	11000
Ceiling (feet)	23000	22000	23000	20000

*Actual performance

The above table is for these planes loaded for entry in the Detroit Races. As service types, the useful load would be increased 180 pounds and the horse-power reduced to 220. The effect of this would be to reduce the high speed about 3%, the climb in 10 minutes would be reduced about 18%, and the ceiling about 8%.

Catapults and Short Landing Devices

For many years the catapult device for launching airplanes at full flight speed from ships' decks has been a matter of experiment and practice in the U. S. Navy until it has now become a definite equipment. There remains its application to commercial or civil aeronautics, next, to permit the departure of airplanes from small spaces on the ground, or from buildings close to business districts of cities. A great drawback to aerial passenger transportation is the present necessity of an aerodrome on the outskirts—with high valuations, loss of time in reaching it, the temporary character imposed by the expansion of real estate programmes.

Coincident with this development must be that of a system for landing in about the same space. Many large buildings offer proper spaces where a suitable landing device is existent.

Many years ago Eugene Ely made one successful experiment in landing upon a platform erected above a ship's deck. The Bureau of Aeronautics of the Navy has now taken up this phase and has conducted some practical experiments which may point the way to a fully satisfactory apparatus or method.

In short, the system thus far tried consists of a series of wires placed across a platform, at a proper height, to the ends of which wires are attached weights in the form of bags of sand. The 'plane is brought into line with the platform and makes contact at one end in the normal manner. A hook on the landing gear engages one of these wires and picks up the burden of the dragging weights. A second wire is engaged, which adds its load to the first and so on to a point where the 'plane is at a standstill.

In one of the trials an airplane was brought to a stop within 38 feet. The distance depends upon the landing speed of the particular airplane. The higher the flight speed, the higher the landing speed is the usual formula.

Flying Along the New Airway.

The first official regular trip on the new airway connecting McCook Field, Dayton, Ohio, with Mitchel Field, Long Island, New York, and Langley Field, Va., via Bolling Field, Anacostia, D. C., and Moundsville, West Va., was recently made by Lieutenant Samuel P. Mills, pilot, and Lieut. Van Meter, passenger. One hundred pounds of photographic supplies, destined for Washington, were carried. Excellent weather was encountered, the round trip from McCook to Langley and return being made in about 10½ hours' flying time. One unscheduled landing was made close to Cumberland on the return trip but no damage resulted.

Lieut. Mills declared himself very enthusiastic over the airways development.

The Officers of the Communication School are Capt. L. P. Hickey, Commanding, 1st Lieutenants J. H. Gardner, Stanley Smith and J. T. Harris. The Communication School Detachment consists of 21 enlisted men.

Both of the above schools are shortly expected to be in operation.

Brook's Field Gets New Hospital Plane

The Primary Flying School at Brooks Field, San Antonio, Texas, recently received a new white hospital plane, designed and built by McCook Field, and delivered via the Repair Depot at Kelly Field No. 1. This plane is a remodeled Curtiss JN6, equipped with a Wright motor, 180 h.p. The fuselage is enlarged to acommodate the patient in a prone position. A seat facing the patient between patient and pilot, has been installed for an attendant. The plane with full load has been given several tests flights by pilots from the field and it is reported that, although it is an ideal ambulance plane so far as the patient's comfort is concerned, it is loggy, nose heavy and slightly underpowered. It is also slower in getting off than a Standard Curtiss JN 6 with 150 h.p. Wright motor.

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REVIEW of WORLD AERONAUTICS

Gibraltar Aviation Base

That great Britain plans to make Gibraltar the most formidable air base in the whole world is alleged by the Spanish aviation magazine Avear.

"The British," says the journal, "have of recent years laid much stress on the fact that owing to changed conditions of modern warfare, both on land and sea, Gibraltar to a great extent has lost its former strategic importance. But the historic rock now enters a new phase. British engineers are busy planning the transformation of Gibraltar into a huge subterranean air station. The hillside will be tunneled in all directions, with vast cellars in which great fleets of airplanes and seaplanes will be in absolute safety from enemy attack. Huge oil tanks, repair shops, bomb and aerial torpedo stores will be complete in the mighty arsenal.

"In the centre of the rock a large hall will house the planes, with galleries running in all directions of the compass to outside landing stations. There will be several tiers connected with each other by powerful elevators. This plan will enable the British to concentrate the largest air fleet ever seen in the world in a place of absolute safety, ready at any moment to sally forth to support naval squadron or undertake offensives over a very wide radius of action.

"Gibraltar will thus regain its former importance as a strategic base, and again become the crouching lion against whom nobody will dare attempt to dispute British sovereignty over the columns of Hercules."

New French Plane

An all-metal battle plane, mounting one French seventy-five field gun, was delivered to the French Government at the Villa Coublay Aerodrome, October 15, by Schnider Steel Company, which owns the Creusot Works.

The plane is driven by four motors of 400 horsepower each. It weighs more than ten tons. Its speed is more than 100 miles an hour. It is a night bombardment plane, capable of carrying several tons of bombs in addition to two pilots, a mechanician and a gun crew. A field gun has been specially mounted on it. The plane can carry fifty shells if necessary. It already has passed the builder's trials, but has not yet begun the Government's trials.

Italian Speed Record

By attaining a speed of 209 miles an hour, Brack Papa captured the world's airplane speed record for Italy and ousted the French champion Sadi-Lecointe from a position he has held for the last two years.

The Italian made his attempt on the world's flying records over the Mirafiori aerodrome, in the suburbs of Turin, with a Fiat R. 700 biplane. In order to be officially accepted, these record flights have to be made both with and against the wind, the average time of the runs being taken as the official figure. Four trips were made over the kilometre, the fastest of these being in $10^{3}/_{20}$ seconds, or equivalent to 217 miles an hour. It is interesting to note that the first world's speed record in the air was established in 1906 at 26 miles an hour.

Brack Papa's machine is a special Fiat construction equipped with a 12 cylinder V-type water cooled engine of 700 h p. It is with this machine that he will take part in the race for the Deutsch Cup, where he will have to meet British and French competition. Brack Papa also holds the world's speed record for 100 kilometres (62 miles) in 20 min., 5 2/5 sec.

The Fokker F-3, equipped with Rolls-Royce Eagle, now in service between Amsterdam and London. It is one of the most efficient European designs.

Seaplane Round the World Flight.

The Air League of the British Empire is sponsoring around the world flight by seaplane.

The machine which it is proposed to use is a Fairey seaplane of the twin-float type, and the machine will be driven by a 600 h. p. Rolls-Royce "Condor" engine. The three aviators who are to make the attempt are Capt. Macintosh, who has for so long been associated with the Handley Page London-Paris air services; Capt. Tymms, of the Air Ministry Navigation Department; and Capt. McCloughry, of the Australian Flying Corps. Capt. Macintosh has had unique experience of flying under all sorts of weather conditions, and he has on several occasions succeeded in bringing Handley Page machines across the Channel in weather which kept the Channel steamers in port. We do not know how much experience Capt. Macintosh has had of seaplane flying, but as the machine to be used is a twin-float seaplane, its handling should not be so very different from that of a land machine.

Regarding the machine itself, but little information is available at the moment; but it will probably follow fairly closely upon the lines of the long-distance machine on which the Portuguese aviators Cabral and Coutinho started out on their trans-Atlantic flight from Lisbon. Thus the type has been thoroughly tried out, and the lessons learned with the first machine should enable the constructors to incorporate any improvements which experience with the first machine may have suggested. We understand that the twin-float seaplane has been chosen mainly because in case of damage it is easier to repair or replace a float than it is to repair the hull of a flying boat. We do not know if it is the intention of the aviators to fit a land undercarriage for some of the stages of the flight, but it would appear that to do so would be a fairly simple procedure, and, in a measure, the effect would be similar to that of using an amphibian machine, but with the difference that the amphibian gear would not have to be carried on board. Needless to say, the machine will be very fully equipped with all modern instruments, and a wireless set of good range will be carried.

The Roll-Royce "Condor" is, at the moment, not so thoroughly tested out as is the famous "Eagle," which has the trans-Atlantic flights, the Cairo-Cape flight, and the London-Australia flight to its credit. As it is, except for size, designed ver much on the lines of the "Eagle," the is no reason to think that it will not wort

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ily uphold Rolls-Royce traditions, especially as, we understand, for most of the stages it will not be necessary to run it at anything like its full power. The most difficult parts of the journey will be from Kamchatka to Canada, and from America to Europe; and for the first part of these stages it is possible that the engine may have to be run nearly all out, until some of the fuel has been consumed. As, however, the "Condor" is very sturdily built it should be able to do this safely for the required length of time. At present the engine is, it will be remembered, being tried out in the Avro 'Aldershot," which made its first public appearance at the Pageant at Hendon.

The route to be followed has not yet definitely been decided upon, but it will be from west to east. The Air Ministry has promised all possible assistance in the way of meteorological and wireless assistance, and it is, we believe, intended to send a spare engine out to Japan. Otherwise it is hoped to be able to complete the whole flight on the same machine. No doubt a few spares will be judiciously distributed along the route.

The actual date of starting has not yet been decided upon, but it appears probable that a start will be made early next year, possibly in January or February, and it is hoped to complete the tour of the world in about three months. We hope to be able to supplement these brief notes with further details later on.

International Air Congress in London.

Following on the Congress International de la Navigation Aerienne held in Paris in November 1921, it is proposed to hold a similar congress in London towards the end of June next year. Group Captain H. R. H. the Duke of York, K. G., G. C. V. O., R. A. F., has consented to become President of the General Council of the Congress and the Right Honourable the Lord Weir of Eastwood, P. C., has accepted an invitation to become a Vice-President. A strong Organizing Committee representative of all phases of British aeronautical activity, including the Air Ministry, has been formed, with His Grace the Duke of Sutherland as Chairman. This Committee is constituted as follows:—

Vice-Chairmen

Major General Sir F. H. Sykes, G. B. E., K. C. B., C. M. G.

Major General Sir W. S. Brancker, K. C. B., A. F. C.
(Director of Civil Aviation)

Lieut. Col. M. O'Gorman, C. B.

Sir Henry White-Smith, C. B. E.

Lt. Col. J. T. C. Moore-Brabazon, M. C., M. P.

Brig. Gen. P. R. C. Groves, C. B., C. M. G., D. S. O.

Members

Brig. Gen. F. L. Festing, C. B., C. M. G.
Brig. Gen. R. K. Bagnall-Wild, C. M. G., C. B. E.
Air Commodore J. M. Steel, C. M. G., C. B. E.
Air Ministry

Lt. Col. A. Ogilvie, C. B.
Mr. Griffith Brewer
Lt. Col. W. Lockwood Marsh, O. B. E.
Royal Aeronautical Society

Col. F. Lindsay Lloyd, C. M. G., C. B. E.
Lt. Col. F. K. McClean
Mr. H. E. Perrin
Royal Aero Club

Mr. C. R. Fairey
Captain P. D. Acland
Mr. Charles V. Allen
Society of British Aircraft Constructors

Mr. G. Holt Thomas
Hon. Sir Newton J. Moore, M. P.
Mr. Shirreff Hilton
Air League of the British Empire

Sir Samuel Instone
Mr. F. Handley Page
Colonel F. Searle
Air Transport

Brig. Gen. Sir F. H. Williamson, K. C. B., C. B. E.
General Post Office

General Secretary.

Mr. Charles V. Allen.

Technical Secretary.

Lt. Col. W. Lockwood Marsh, O. B. E.

The Congress will be open to all countries which are signatories of the International Air Convention, or are represented on the Federation Aeronautique Internationale; individual invitations are being issued through national committees in process of formation in each country. Membership will be divided into two classes: (a) Ordinary Members, and (b) Associate Members, comprising the families of ordinary Members, at a subscription of £1 and 10/- respectively.

According to present arrangements the Congress will occupy one week during the last fortnight in June 1923, the reading of papers alternating with visits to various aircraft factories and establishments. It is hoped that the Air Ministry will be able to arrange for the Royal Air Force Pageant to take place on the Saturday of the Congress week and that the Royal Aero Club may organize a race meeting on the Tuesday or Thursday. Monday, Wednesday and Friday will be devoted to the reading of papers, and discussions thereon, which will be divided into four or more main groups or sections which will hold simultaneous sessions in different rooms.

As the time available for the reading of papers will be limited a "Reading Committee" is to be formed, though it is hoped to arrange that the official report of the Congress to be published later shall contain a wider selection of the papers sent in. An official reeeption will be held in the evening of the Monday of the Congress week and the proceedings will be closed by an official banquet on the Saturday.

It is important that the Congress should not be confused with the British Air Conference called each year by the Air Ministry. The latter is of a domestic nature dealing with aeronautical matters so far as the British Empire is concerned. The Congress, on the other hand, is essentially international in character and is intended to be one of a series to be held in various countries at which experts may meet to discuss the technical and scientific development of aeronautics in all its aspects.

Organization of Aerial Mails in Argentine.

In order to develop the aviation branch of the Argentine Army and to provide at the same time an improved air service from the capitol to the smaller commercial centers, the Director of the Aeronautic Service has suggested the establishment of an aerial mail system by cooperation between the Ministry of War and the Direction General of Post Offices & Telegraphs, the Department of Commerce is advised by Vice Consul Houlahan, Buenos Aires.

The plan meets with the approval of the Ministry of War and the Postal Administration, but the latter has stipulated that the administration of the service in peace times shall be under the exclusive jurisdiction of the Post Office Department, since that branch of the government would be responsible to the public under ordinary conditions. The suggested route from Buenos Aires includes the cities of Azul, Bahia Blanca, Patagones, San Antonio Oeste, Rawson, Comodoro Rivadavia, Rio Gallegos, and Ushuaia.

A joint committee is now preparing a detailed plan, including the schedule of deliveries, time of flights, mail capacity for each trip, charges, etc.

London-Manchester Air Service

The first British air service which will connect Manchester and London by air is to be opened by the Daimler Airway very soon.

Maj.-Genl. Sir W. S. Brancker, Director of Civil Aviation, completed arrangements recently whereby the Diamler Airway will run one of their Napier-engined ten-seater expresses between London and Manchester daily in order to connect with the air services from London to the Continent.

From London to Manchester the air express will leave in the afternoon after the aeroplanes from the Continent have arrived at the London Air Station.

This new internal airway will bring Manchester within five hours of Paris and seven hours of Cologne, while in the Spring of 1923 it will be possible to fly from Manchester to Berlin and Copenhagen in the course of a day.

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p. The engine burned 19.1 gallons of gas and 1.3 gallons of oil an hour at 1480 R.P.M., so was safe for thirteen and one-half hours.

q. Airplane gasoline was used except at Jacksonville, where high test gas not being available, commercial gas was used.

In 1911 and 1912 Calbraith Rodgers flew a Wright B from the Atlantic to the Pacific Coast in easy stages, taking weeks for the trip. Robert G. Fowler, one of the founders of the present L.W.F. company, flew a similar machine from the Pacific Coast east.

In 1919 the Army held its great transcontinental reliability test between New York and San Francisco, starting at both ends simultaneously on October 8, 59 planes participating. Forty-four planes left New York and fifteen left from 'Frisco. Twenty-six of the New Yorkers finished at Frisco and seven of the Californians at Mineola. Out of the total number, ten 'planes made the complete round trip, each crossing the United States twice in either direction.

In February, 1921, Alexander Pearson, 1st Lieut., Army Air Service, attempted a transcontinental flight in record time. He intended to fly from El Paso to San Antonio and then to Jacksonville, Fla., for the start westerly to the Pacific Coast. During the stage El Paso-San Antonio he got into difficulty with his engine and landed about 70 miles south of the Border and suffered many hardships in getting back to civilization and gave up the flight. About three months later a salvage expedition was sent out from Del Rio, Tex., and this found the plane intact. After installing a new engine Lieut. Doolittle the new record holder, took off and flew the Pearson machine back to Del Rio although it had been exposed to the elements all this time.

On February 21, 1921, 1st Lieut. W. D. Schey made the first fast transcontinental trip, flying easterly from Rockwell Field, San Diego, in a DH4 carrying 274 gallons of gas and 24 gallons of oil. He was forced to make a descent at Bronte, Tex, early in the morning after flying all night. Three hours later he took off and reached Dallas at about noon. Leaving here at 10:14 in the evening and made a non-stop flight to Jacksonville, Fla., arriving there February 23, after 2 days 9 hours and 24 minutes elapsed time. His flying time was 22 hours 27 minutes.

Lieut. Doolittle, the new record-holder, is the first white man to travel across the continent within 24 hours elapsed time. Prior to this flight he flew from Kelly Field, Texas, to Jacksonville. While here he flew up to Bolling Field, Washington, and from there to Dayton for consultation with the Engineering Division of the Air Service, and return. Other feats have been non-stop flights from Kelly Field to San Diego and back in easy stages and several times he has made non-stop flights between Kelly Field and Jacksonville.

Lieut. Doolittle has been ordered to McCook Field for study work.

Gliders, Sail-Planes, and the Peace Treaty

By Lieut. Col. A. Guidon.

Air Attache At the Italian Embassy

GLENN H. Curtiss, in a statement of the Aeronautical Chamber of Commerce, says:

"The achievement of the German Gliders may be regarded as a direct result of the restrictions imposed on Germany by the terms of the Versailles Treaty."

It can be of some interest to report a brief of discussions of the Aeronautical Interallied Commission in Paris, in 1919, when the question of such restriction arose.

The Supreme Council of the Peace Conference had requested the Aeronautical Commission to express its opinion regarding this point:

> After the Treaty of Peace and in view of the easy transformation of commercial aircraft into weapon of war will it be necessary to prohibit civilian aviation in Germany and all other Enemy States?

The Aeronautical Commission answered YES, at majority but the delegate of the United States stated:

> He was CONSIDERING all such restrictions of the entire flying activities of Germany and her Allies after the Signature of the Treaty of Peace to be NEITHER WISE NOR PRACTICABLE.

In the Report on the measures to be taken with regard to Aviation in Enemy Countries after the Treaty of Peace the American Delegation has desired to explain even more clearly its reason for: voting against certain measures which it was proposed to recommend to the Peace Conference:

> Certain of these measures could not be made a part of a Treaty concluded with the Enemy States. Some of these measures that could be inserted in the Treaty involve a measure of control after the signature of the Treaty of Peace, a control which the Conference of Peace has refused to impose.
>
> Such of these measures that could not be inserted in the Treaty of Peace involve great problems of national policy and an agreement on these points, between the Nations that have been at war with the enemy States, although desiring to invite in the other Delegations of the Commission in submitting all these measures to the Conference of Peace, it should be understood that the American Delegation does not recommend their adoption and they do not wish, in any way, to bind the United States separately or in concert with any other country to adopt any one or the whole of these measures.

As a consequence, the Treaty of Peace brought no restrictions on the Commercial Aviation; such restrictions were imposed on Germany, a long time afterwards, contrary to the precise dispositions of the Treaty of Versailles.

It is quite sure that if the Congress of the U. S. had approved the Versailles Treaty, such restrictions would never have been imposed on Germany.

Soaring Flying may not have a decisive importance in the development of aviation, but it is certainly a source of useful data for the general progress of aeronautics.

The wonderful test of the German soaring planes prove how far-seeing and right-seeing the standing of the American Delegation was, when it considered any restriction of commercial aviation NEITHER WISE NOR PRACTICAL.

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FOREIGN TECHNICAL DIGEST

HANDLEY PAGE TWIN-MOTORED BIPLANE

THIS new type machine, now being used on the London-Paris Service, for carrying passengers and freight, is the outcome of experience obtained in commercial transport during the past three years with our converted war and commercial machines, and develops particularly the W. S. type machine which gained the Air Ministry's prize of £8,000 for large Aeroplanes in their trials in 1919.

SALOON

The interior of the fuselage, which is entirely free of all bracing wires, stays, struts, etc., is one large saloon, 18 feet long, fitted with 12 comfortably upholstered chairs.

Racks are provided for light luggage and a map of the route provided for in the light front of the saloon in full view of all passengers; this, together with an altitude indicator, speed indicator and clock, add greatly to the interest of the passengers in their journey.

Great care has been taken to provide adequate ventilation, free from draughts, and an excellent view is obtained in all directions, due to the large windows of Triplex Glass provided.

A well appointed lavatory is provided in the back of the saloon and a cuspidor is arranged next to each chair, which can be comfortably used in the event of air sickness. Provision is also made for carrying a fresh supply of water.

The saloon is provided with a number of emergency ripping panels in order that maximum safety and the quickest exit is obtainable in the event of such being necessary. A door leads through the forward freight compartment to the pilot's cockpit in the event of communication being desirable in flight.

FREIGHT

Freight is carried in two separate compartments, each capable of carrying 6 cwt., one forward between the saloon and pilot's cockpit, 80 c. ft., the other, 90 c. ft., being immediately aft of the saloon. Each is provided with a separate door, so that the passengers are not inconvenienced by the loading of freight.

LOAD CARRIED

Weight light (with water)....	7,260 lbs.
Pilot..........................	160 "
Mechanic......................	
Petrol for 3¼ hours (137 gallons)	1,000 "
Oil (10 gallons)	100 "
Passengers (at 180 lbs.) (12)	2,160 "
Cargo......................	1,820 "
	12,500 lbs.

Note: It is not considered necessary that a mechanic should be carried under normal conditions.

PERFORMANCE

The certified performance is:—

With Load	12,500 lbs.	11,500 lbs.
Maximum speed at 1,000 ft........	96 m.p.h.	101 m.p.h.
Ground rate climb	370 ft/min.	425 ft/min.
Service ceiling..	7,500 feet.	8,700 feet.
Landing speed...	44 m.p.h.	42 m.p.h.
Run to "get off".	320 yards.	300 yards.
Run to "pull up".	240 yards.	240 yards.

RELIABILITY

By the use of twin engines greater reliability is obtained in the machine than that which is possible with a single engine, as each engine is independent of the other in the event of a breakdown and the machine is proved capable of flying on the remaining engine.

Great attention has been paid in order to obtain a slow landing speed, which is an absolute necessity for safety.

The pilot, seated in the extreme front of the aeroplane, has an entirely uninterrupted view. A seat is provided by the side of the pilot in case it is required to carry a mechanic or navigator for special purposes.

A Marconi system of Wireless Telegraphy is fitted for the use of the pilot, and a "listening in" set is provided in the saloon for the benefit of the passengers.

EQUIPMENT

The following equipment is fitted:—

Wireless Telegraph Apparatus (Civil type)
2 Air Speed Indicators (One in Cabin)
2 Altimeters. (One in Cabin)
Lateral Clinometer.
2 Revolution Indicators.
2 Radiator Thermometers.
2 Oil Pressure Gauges.
2 Petrol Level Gauges.
2 Oil Temperature Thermometers.
1 Watch and Holder.
1 Instrument Lighting Set.
3 Pyrene Fire Extinguishers (Two in Cabin)
1 Pilot's Belt.
1 Compass.
1 Turning Indicator.

COST OF UPKEEP

Each engine is provided with a separate petrol tank which is fixed on the top plane, so that the usual power petrol pumps are dispensed with, as also the emergency hand pump and all the attendant piping, gauges and control cocks.

On account of the very large number of Rolls-Royce engine spare parts obtainable at economic prices, the engine upkeep is of particularly low cost.

The location of the engine is such that no cowling is necessary, and this fact, combined with their positioning, makes the dismantling for overhaul a very simple and quick operation.

ALTERNATIVE ENGINE

Napier "Lion" Engines of 450 H. P. may be fitted in this type machine, without any increase in weight, and the performance increased to:—

Maximum speed at ground..	120 m.p.h.
Rate of climb at ground...	750 ft/min.
Service Ceiling..............	12,000 ft.
Landing speed................	44 m.p.h.

The Handley-Page Biplane of the Type Used in the Cross-Channel Passenger Service.

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THE NEW SIEMENS-HALSKE AERO ENGINE

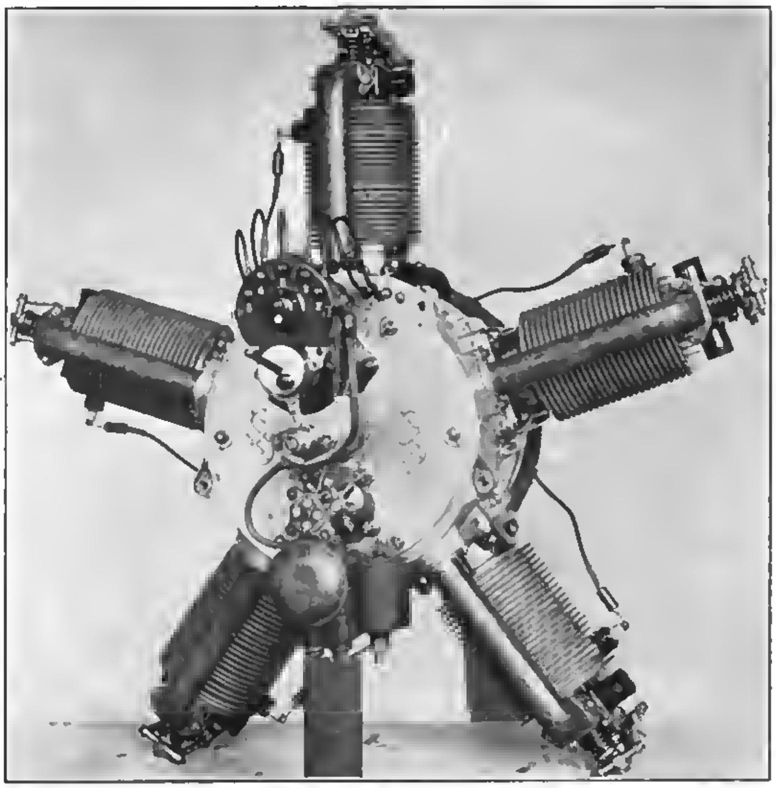
THE note of allies on the 14th of April 1922 making determinations to the German Aircraft Industry says in rule I:

"Every one scater-aeroplane with a greater performance than 60 h. p. is taken for a military object and therefore as implement of war."

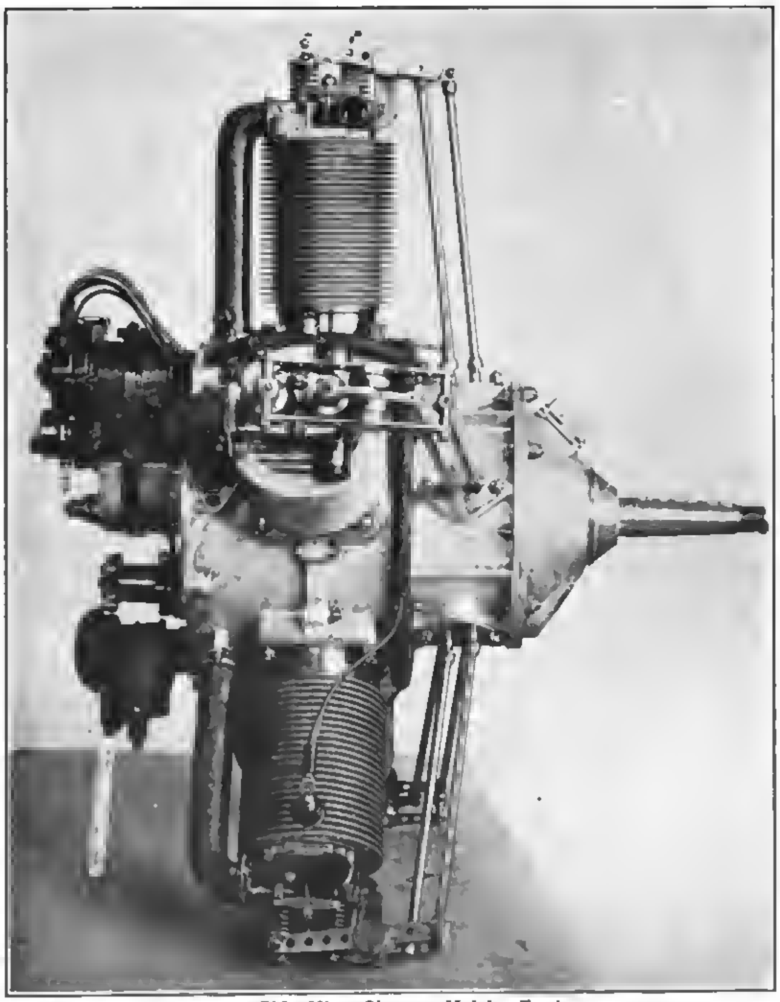
Consequently German aircraft works have built very interesting new aero engines and aeroplanes.

The new Siemens-Halske aero engine is shaped as a star-motor with 5 fixed cylinders.

It is a four stroke engine with air cooling. Its bore is 4" and its stroke 4,7". The crank shaft, constructed in highly valutc material, consists of two parts with ball bearings, laid in the split aluminum crank shaft chamber in bronze bushes. On the main connecting rod, likewise running on ball bearings, the secondary connecting rods are joined. The cylinders are made of steel with aluminium mantles furnished with ribs for air cooling. The pistons are made of aluminum. On the cylinders there are placed the inlet and the exhaust valve chambers. The inlet and the exhaust valves are mechanically operated by thrusting poles.



Rear View Siemens-Halske Engine



Side View Siemens-Halske Engine

The opening and closing of valves is done by tipping arms lying into each other. They are laid down in the case of exhaust valve, and the axle of which is in ball bearings. The trusting poles are operated by tappets, gliding in guides easily to be changed and operated by a cam, corresponding with the gear times of the motor. Toothed wheels lying in the forepart of the crank shaft chamber with gear ratio corresponding to the valves-operation, drive on the came, going in ball bearings. A cover of cast aluminum shuts the forepart of the crank shaft chamber. In this cover there is in a casted bronze bush the strong ball thrust bearing for accepting the shear in the axe.

In the back part of crank shaft chamber there is the suction passage for the explosive gas mixture, conducted to the inlet valves by sucking tubes easily to be taken of from a special carburetor. An air pump driven by the crank shaft by means of eccentric keeps the pressure constantly when the petrol tank is at the bottom. This pressure takes care of conducting the fuel to the carburetor. At the back close cover of the crank shaft chamber there is one high tension ignition device driven by tooth-wheels. The ignition device is secured in its position by fitting pins and kept on the bad plate by a spaning band easily to be untied. The cables are put in a pipe. Each of the five cylinders has a sparking plug. There can also be connected two magnetic devices and then each cylinder receives two separated sparking plugs. An oil pump likewise arranged at the back cover takes the oil through t.. hollow crank shaft to the engine parts that

(*Concluded on page* 571)

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Publications and Technical Notes of the National Advisory Committee for Aeronautics

IN entering upon its eighth year of work, the National Advisory Committee for Aeronautics, established by an act of Congress in March, 1915, has inaugurated one of the most productive methods of research yet devised for the solution of original problems. The towing of full-sized surfaces in the air and the development of the new instruments which record photographically during actual flight the speed through the air, the variations in loading on the wings in flight and on landing or taking off, control positions and others, carry the battle of research far into the enemy's country.

All the results of the research work of the Committee are available in either printed or mimeographed form. Following is a list of the *printed* annual and separate reports. This list will be found invaluable to students, constructors, operators, users and libraries throughout the country. It is the aim of *Aerial Age* to furnish its readers with the world's aeronautical information, either directly or indirectly.

The annual reports of the National Advisory Committee for Aeronautics contain all technical reports prepared by this Committee. The technical reports are also published separately unless otherwise indicated. Those marked with an asterisk (*) are not obtainable as separate reports but are available only in the annual reports. *All reports may be had on application to the Superintendent of Documents, Government Printing Office, Washington, D. C.*, which should be accompanied by remittance in the form of coupons, postal money order, express money order, New York draft, or certified check. If currency is sent, it will be at sender's risk. Foreign orders should be accompanied by international money order or New York draft. Postage stamps, coins defaced or worn smooth, foreign money, and uncertified checks will not be accepted.

First Annual Report (1915)

The First Annual Report Contains Reports Nos. 1 to 7. Price is $ .35

No.

*1 REPORT ON BEHAVIOR OF AIRPLANES IN GUSTS.
Part 1. Experimental Analysis of Inherent Longtitudinal Stability for a Typical Biplane.
By J. C. Hunsaker.
Part 2. Theory of an Airplane Encountering Gusts.
By E. B. Wilson.

*2 INVESTIGATION OF PITOT TUBES.
Part 1. The Pitot Tube and Other Anemometers for Airplanes.
By W. H. Herschel.
Part 2. The Theory of the Pitot and Venturi Tubes.
By E. Buckingham.

*3 REPORT ON THE INVESTIGATIONS OF AVIATION WIRES AND CABLES, THEIR FASTENINGS AND TERMINAL CONNECTIONS.
By John A. Roebling's Sons Company.

*4 PRELIMINARY REPORT ON THE PROBLEM OF THE ATMOSPHERE IN RELATION TO AERONAUTICS.
By Prof. Charles F. Marvin.

5 RELATIVE WORTH OF IMPROVEMENTS ON FABRICS.
By the Goodyear Tire and Rubber Company.

*6 INVESTIGATIONS OF BALLOON AND AIRPLANE FABRICS.
Part 1. Balloon and Airplane Fabrics.
By Willis A. Gibbons and Omar H. Smith.
Part 2. Skin Friction of Various Surfaces in Air.
By Willis A. Gibbons.

*7 THERMODYNAMIC EFFICIENCY OF PRESENT TYPES OF INTERNAL COMBUSTION ENGINES FOR AIRCRAFT.
By Columbia University.
Part 1. Review of the Development of Engines Suitable for Aeronautical Service.
Part 2. Aero Engines Analyzed with Reference to Elements of Process or Function.

Second Annual Report (1916)

This Report Contains Reports Nos. 8 to 12. Price $1.25. It is regrettable that this volume is out of print.

*8 GENERAL SPECIFICATIONS COVERING REQUIREMENTS OF AERONAUTICAL INSTRUMENTS.
By the National Advisory Committee for Aeronautics.

*9 NOMENCLATURE FOR AERONAUTICS.
By the National Advisory Committee for Aeronautics.

*10 MUFFLERS FOR AERONAUTICAL ENGINES.
By Professor H. Diederichs and Professor G. B. Upton.

*11 CARBURETOR DESIGN—A PRELIMINARY STUDY OF THE STATE OF THE ART.
By Charles Edward Lucke, Assisted by Friederich Otto Willhofft.

*12 EXPERIMENTAL RESEARCHES ON THE RESISTANCE OF AIR.
By L. Marchis.

Third Annual Report (1917)

This volume contains Reports Nos. 13 to 23. Price $1.50

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Part 3. Current Meteorology and its Use.

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By Wm. F. Durand.
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Part 2. Radiator Design.
Part 3. Spark Plugs.

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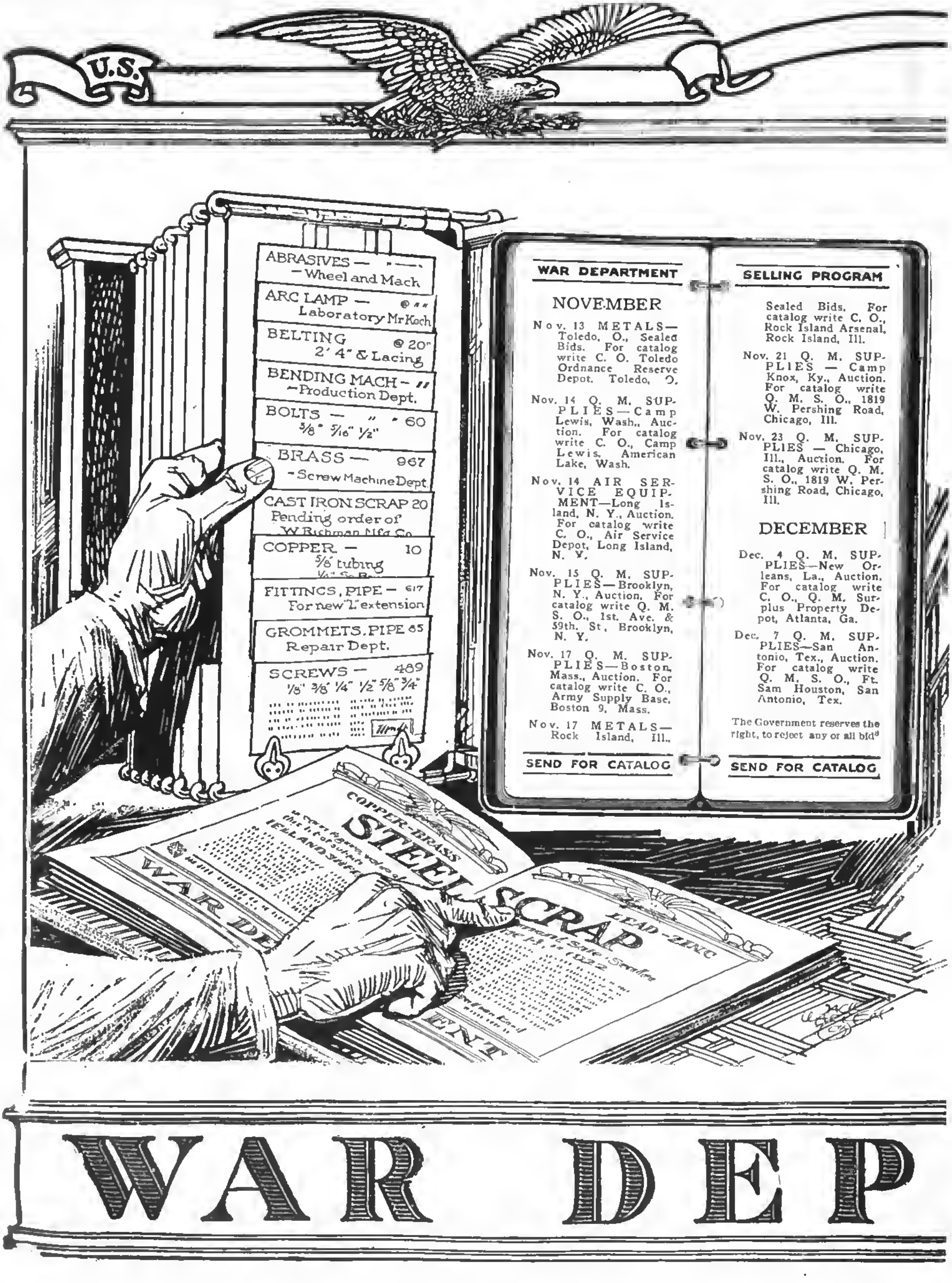

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(Concluded from page 539)

In any particular case for which the performance is known, the formula is quite accurate in predicting the effect of small changes in W., B. H. P., or S. To do this, Equation (2a) is solved for the exact value of K by substitution of the original data and this value is used with the new values of $\left(\frac{W}{HP}\right)$ or $\left(\frac{W}{S}\right)$ to obtain the new ceiling.

The absolute ceiling for any common values of $\left(\frac{W}{HP}\right)$ and $\left(\frac{W}{S}\right)$ may be read directly from Fig. 1 which is based on Equation (2a) with K = 19000.

Table 1.
Value of constant K in

$$H = K \log_{10} \frac{10000}{\left(\frac{W}{HP}\right)^2\left(\frac{W}{S}\right)}$$

Aeroplanes	$\left(\frac{W}{HP}\right)$	$\left(\frac{W}{S}\right)$	H	K	Remarks
JN-4D......	22.6	5.72	9250	17300	Landplane
DH-4........	11.20	7.62	19200	19800	"
VE-7........	11.60	7.36	18900	19200	"
MB-3........	7.00	8.4	25500	18400	"
M-80........	8.80	12.3	19900	19500	"
Nieuport "Night-hawk".....	6.60	7.77	29000	19800	"
Fokker D-V11.....	8.47	8.36	25000	20400	"
Mrtinayde Scout.....	7.50	6.95	26800	19000	"
N9-H........	18.30	5.54	14500	19500	Flt. seaplane
R-9L........	10.9	7.10	20000	18500	"
HA-2........	10.40	8.00	20500	19200	"
F-5-L........	18.10	9.30	9500	18500	Boat seap'ne
DT-1........	17.20	9.75	10200	19000	"
NC-5........	21.30	9.70	6000	17000	"

(Concluded from page 563)

are to be oiled and sucks the superfluous oil out the motor and represses it to the oil tank.

The motor is hanged up by means of eyes casted on the back part of the crank shaft chamber, whereby the border of the back close-cover serves as centring.

The aero engine will be built with 5 cylinders, 50/55 h. p. for one seater aeroplanes and with 7 cylinders, 80/85 h. p. or 9 cylinders, 100/110 h. p. for other aeroplanes.

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Complete new sets Standard J1 panels, wires, wings, struts, tailunits, original boxes .... $ 165.00
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Statement of the ownership, management, circulation, etc., required by the act of Congress of August 24, 1922, of Aerial Age published monthly at New York, State of New York, County of New York, for October 1, 1922.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. Douglas Wardrop, who, having been duly sworn according to law, deposes and says that he is the Editor of the Aerial Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: Aerial Age Co., Inc., 5942 Grand Central Terminal, New York. Editor: G. Douglas Wardrop, 5942 Grand Central Terminal, New York. Managing Editor: None. Business Manager: G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Aerial Age Co., Inc., 5942 Grand Central Terminal, New York.
G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

NONE

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is—— (This information is required from daily publications only.)

G. Douglas Wardrop, Editor.

Sworn to and subscribed before me this 26th day of September, 1922. Daniel F. Nugent, Notary Public, Queens County, 206. My commission expires March 30, 1923. Certificate filed in New York Co. 97.

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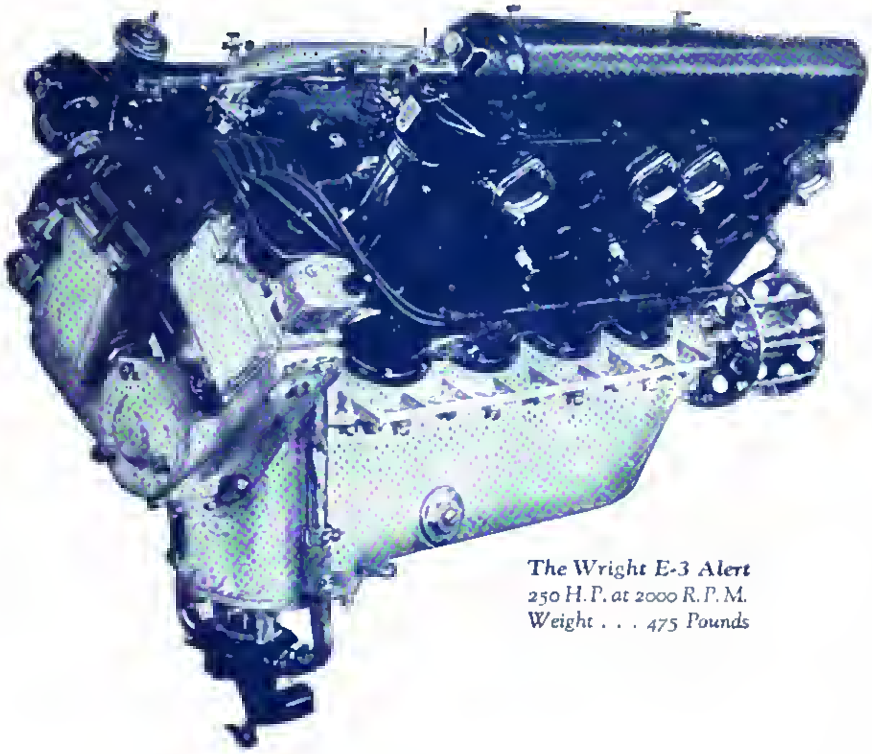

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With which Flying is consolidated

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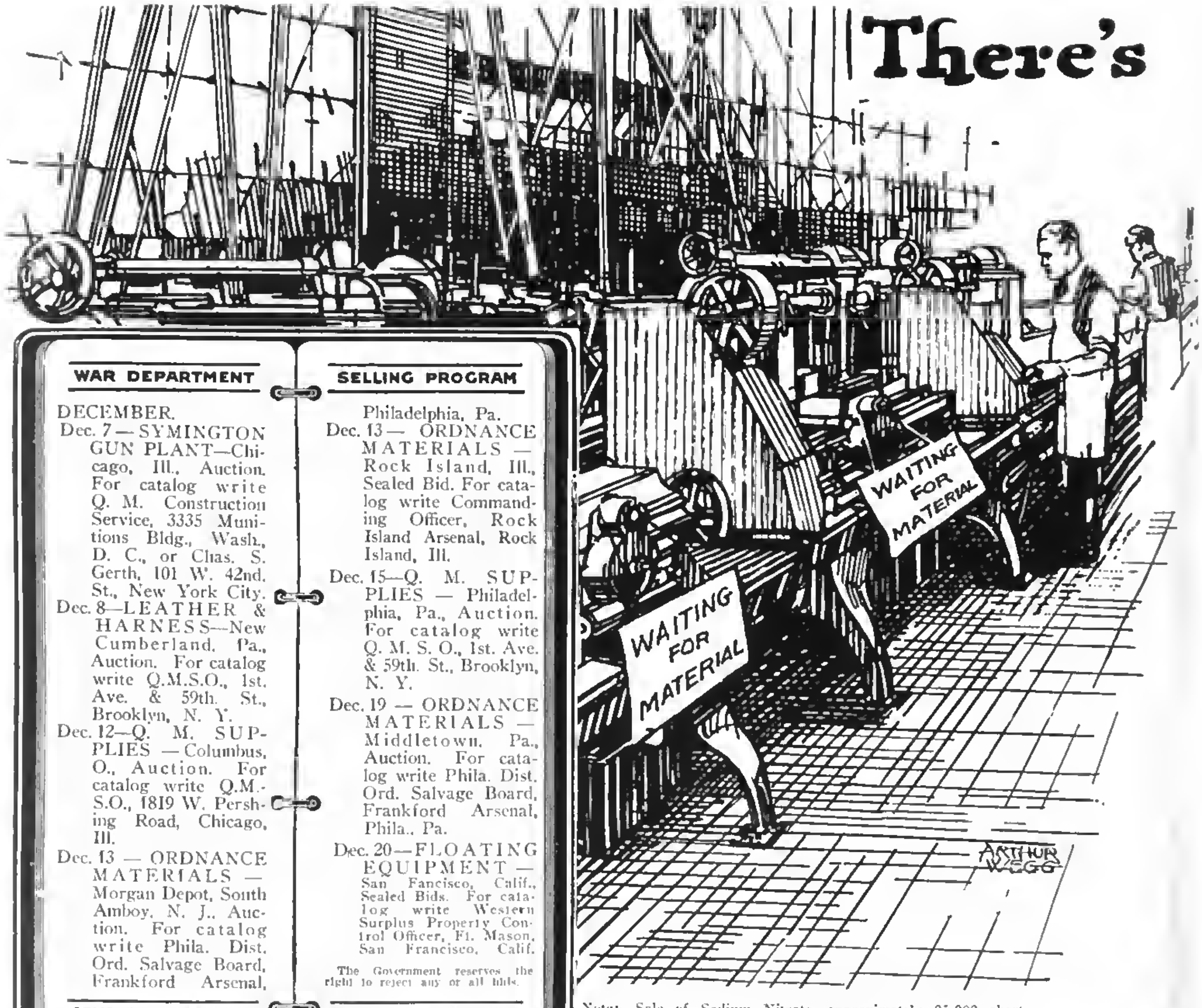

WAR DEPARTMENT SELLING PROGRAM

DECEMBER.

Dec. 7—SYMINGTON GUN PLANT—Chicago, Ill., Auction. For catalog write Q. M. Construction Service, 3335 Munitions Bldg., Wash., D. C., or Chas. S. Gerth, 101 W. 42nd. St., New York City.

Dec. 8—LEATHER & HARNESS—New Cumberland, Pa., Auction. For catalog write Q.M.S.O., 1st. Ave. & 59th. St., Brooklyn, N. Y.

Dec. 12—Q. M. SUPPLIES—Columbus, O., Auction. For catalog write Q.M.-S.O., 1819 W. Pershing Road, Chicago, Ill.

Dec. 13—ORDNANCE MATERIALS—Morgan Depot, South Amboy, N. J., Auction. For catalog write Phila. Dist. Ord. Salvage Board, Frankford Arsenal, Philadelphia, Pa.

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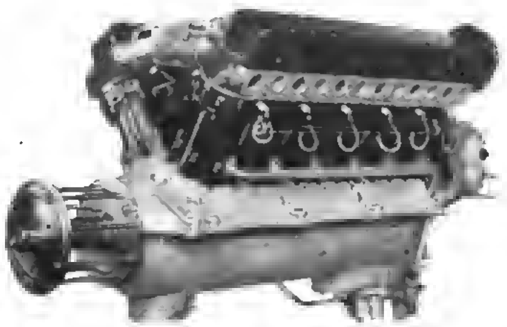

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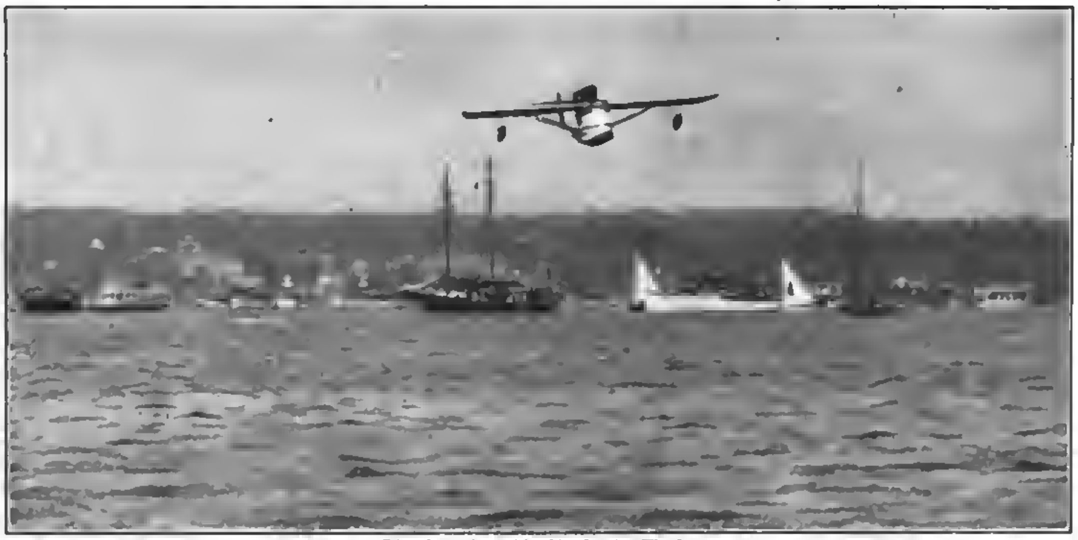

The Loening Air Yacht in Flight

New York to Detroit via the Air-Water Route

This Story Was Written By a Woman Passenger on the Flight Described

SUCH a day! And such a Ship! Like a great throbbing bird our perfectly timed Liberty purred a welcome as we climbed aboard at Port Washington at 1:06 P. M. on Thursday, 31 August. Slowly and gently the waters of Long Island Sound slipped away as we rose to a two thousand foot level and banked onto our course, headed for the blue waters of the Hudson. New York with its lofty buildings and dejected tenements soon was lost to view as the majestic Palisades guided us on our way up the wonderful river they so silently guard.

Approaching the hills near West Point we gradually increased our altitude to three thousand feet, flying in this position until after leaving Poughkeepsie, when we came down to within one hundred feet of the river. As we were nearing Albany, we sighted a New York Central train, bound for Chicago, and though it was travelling at a high rate of speed, it could not compete with our "Loening" and soon it was lost to view.

We landed at the Albany Yacht Club at 2:32 P. M. just 1 hour, 26 minutes after leaving New York. After replenishing with gasoline we were again on our way, rising at once to an elevation of 5,000 feet in order to have a good altitude to cross over Glen Falls. We passed many beautiful lakes and hills but our real treat came when we sighted beautiful Lake George lying so peacefully in the heart of the Adirondacks. After viewing the beautiful panorama spread before us one can easily appreciate why this is called "America's Playground of the Alps". We landed at the south end of the lake to take on more gasoline and incidentally a sandwich for ourselves.

We hated to leave such a beautiful spot and only the necessity of making distance pulled us away. The passing landscape as we flew over Lakes George and Champlain was very picturesque; the Green Mountains of Vermont to our right and rolling farm lands to our left, dotted here and there with small lakes and towns made the picture complete. We passed a moss-covered fort, apparently in good condition, but were unable to determine its name.

After leaving Lake Champlain we followed the Richelieu River and as we reached the St. Lawrence River, we thought it wise to stop at St. Charles, Richelieu, for more gas. This was the first ship to make a landing at this town and if Pegasus, himself, had swept down upon them, I don't think they would have been more surprised. The entire population was down at the dock to give us a super-cordial welcome. His Royal Highness, himself, could not have been treated with more prominence. Unfortunately, none of us could speak their language but a little girl acted as interpreter and we were extended every courtesy possible.

We left St. Charles at 7:37 P. M., flying north over the river to a point probably twenty-five miles north of Montreal where we crossed over to the St. Lawrence River and then turned south, passing over Montreal at 8:08 P. M. and gliding into the canal at Lachine, as the last ray of light was slipping beyond the horizon. Our actual flying time from New York was four hours, twenty-three minutes. When our ship was safely moored we motored to a hotel in Montreal where we did justice to a real steak with all of its appurtenances.

Thus ended the first day of our journey for all except our sturdy pilot. He, who had guided us over rivers, lakes and mountains without one slip of the control and who had earned a night's repose was awakened in the wee small hours by a loud knocking on his door and two men entered uninvited, one an Assistant Manager of the hotel, the other Police Sergeant LaPorte. They turned on the light and at once began to put our pilot through the third degree, but when they found out we were just travellers with no ulterior motive other than to get our ship, as well as ourselves, safely to Detroit, they left, apparently satisfied.

The next morning we awakened to find a bright sun and a blue sky to tempt us to continue our flying, but to leave such a romantic city without seeing at least a few of its magic spots seemed criminal, so we decided to defer our leaving until later in the day and spend a few hours sightseeing. As we strolled down the main street we saw many sights of interest, some amusing. The over-dressed American tourists were quite a contrast to the Canadians in walking shoes and knickers, sauntering along, pointing with their canes to objects of mere significance. We hired an automobile to take us to Mount Royal. This was a most delightful ride and from the mountain top we were able to get a good view of the City and the adjacent country. We returned to our hotel late in the afternoon and as the "call of the air" was so prevalent in all of us, we decided to take a short hop before dinner.

We left the Montreal Boat Builders Dock at 5:42 P. M. and as we had fourteen miles of rapids to cross we climbed at once to 2200 feet. After passing Ogdonsburg, New York, we came down to

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one hundred feet above the water so as to give us a good view of the beautiful Thousand Islands which we were nearing.

Looking over the blue expanse of the waters of the Islands we turned our thoughts back in the dim vista of the ages and tried to visualize this region in its undeveloped natural condition, as it was when inhabited by the Iroquois and Algonquins—when wigwams and dense forests stood in the place of stately mansions and landscaped gardens, and birch-bark canoes traversed the rivers instead of luxuriant yachts. It is then we realize how Longfellow was inspired to write his beautiful poem "Hiawatha". It would bankrupt the English language to describe the virtues of the Thousand Isles. Only by seeing can one appreciate its beauty and know why it is the chosen mecca for tourists as well as the summer playground for our country's most prominent people.

We landed at Alexandria Bay, the Hub of the Thousand Islands, at 7:20 P. M., our flying time from Montreal being 1 hour, 34 minutes.

The next morning after a short walk around the bay, we resumed our journey. We had twenty minutes of flying over the Islands before we left the river to follow the southern shore of Lake Ontario. The air was very rough so after flying one hour and a half we landed at Sodus Point for luncheon and to wait for the wind to subside.

When we started again at 4:35 P. M. we began at once to climb and by the time we reached the Niagara River we had attained an altitude of 5200 feet. I think we had our greatest thrill at this point as we knew that soon we would experience a few minutes of tricky flying.

We passed over Niagara Falls at 6:11 P. M. at an elevation of 4700 feet. The visibility was perfect and we had a wonderful view of the Falls and Rapids from this altitude. When the treacherous waters were passed we began to gradually descend and landed at the Buffalo Yacht Club at 6:20 P. M.

We spent the night in Buffalo and most of the following day the weather was not conducive to safe flying. In the afternoon the rain ceased and the sun began to shine, so we left our mooring at 4:17 P. M., headed for Lake Erie and home. Flying along the north shore of the lake we passed Port Carbone and Welland Canal at an elevation of 1400 feet. When we reached Rondeau Harbor we had to land for gasoline and as it had to be carried some distance it took considerable time, and we were forced to stay all night. There is no hotel there, but we were taken in by some very hospitable Detroit people and spent a very enjoyable evening.

We left Rondeau Harbor at 9:04 the next morning, following the Lake Shore to the Detroit River. Bois Blanc Island and Grosse Isle were sighted and we then knew our wonderful journey was fast coming to an end. Owing to the perfect visibility, we had an excellent view of the City and after circling around Belle Island we landed at the Detroit Yacht Club at 10:25 A. M. The actual flying time from New York to Detroit via the water route was 12 hours and 8 minutes.

A trip in a Leoning Aero Yacht is always a pleasure but when it takes one over an ever-changing panorama of the most beautiful scenery in the world, it is a delight which will linger in the memory forever.

The Airplane Carrier Langley

OF the three new types of ships of the U. S. Navy, the new battleships, authorized in the 1916 program and the largest and most powerful in the world, the fleet submarines and the steel airplane carrier ship "Langely," the latter is obviously of first importance to the aeronautical world.

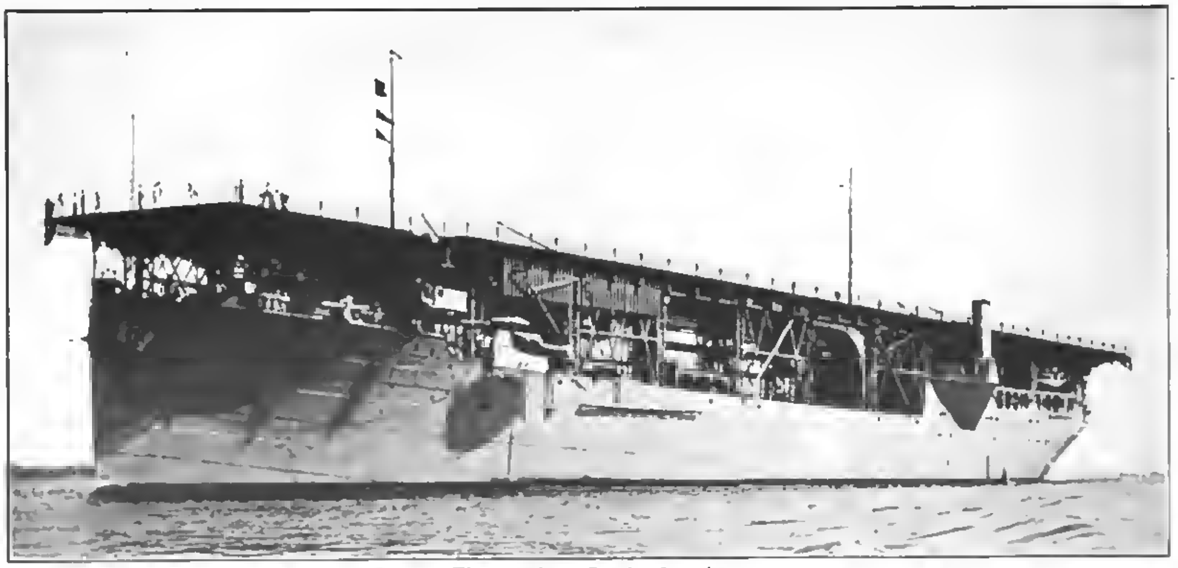
This last vessel is the old collier "Jupiter," remodeled until her original designers could scarcely recognize her. She was launched in 1912 and was as novel then as now for she was the first to be driven by electric turbines of 7152 horsepower. Placed out of commission as a collier on May 24, 1920, she has been refitted at the Norfolk, Va., Navy Yard, for her new role.

Her present characteristics are as follows:

Length between perpendiculars	520 ft.
Length overall	542 ft.
Beam	65 ft.
Speed about	15 knots
Displacement about	12,700 knots
Corresponding draft about	18 ft. 10.5 ins.
Gasoline capacity	578 tons
Fuel oil capacity	2000 tons
Officers	45
Aircraft mechanics	45
Crew	229
Guns on lower deck, four of 5 inch	
Depth of hold	36 ft. 9 ins.

All of the coal handling gear has been removed and in its place has been erected a flying deck, located about 56 feet above the water line, extending from bow to stern, a length of about 525 feet and a width amidships of about 65 feet. This deck is flush all over, and makes an ideal floating aerodrome.

A huge electric elevator, normally flush with the flying deck, 47 fect by 36 teet,



The Airplane Carrier Langley

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hoists the 'planes from assemblage space on the main deck or from the hold. Forward of the elevator is a "palisade" of channel steel, normally flush with the deck, capable of being raised about 10 ft. up across the deck and on two sides to provide a wind break for protection to the airplanes while being assembled or handled on the flying deck.

Five ton jib cranes, with large outreach, one on each side of the vessel, can hoist seaplanes out of the water and land them on the hangar deck, the deck next below the flying deck. Beneath the flying deck forward and aft of the elevator are electric traveling cranes of five ton capacity provided for hoisting 'planes out of the hold and for transferring them fore and aft to the shop spaces and elevator. Shop facilities for repairing include: machine shop, wing repair shop, molding shop, metal shop, store rooms, blacksmith shop, armory, foundry, torpedo repair shop, photograph laboratory.

While open hangar space is provided between the main and flying decks, hold spaces are arranged for the stowage of aircraft and accessories, aircraft ammunition, fuel oil, gasoline and stores.

Quarters include accommodations for the ship's own complement and the officers and enlisted personnel assigned to the care and operation of the airplanes. In addition to berthing spaces the quarters include hospital, laundry, butcher shop, bread room, general mess pantry, general issuing room, food service room, etc.

Forward of the forward mast is a trapdoor lookout for the use of officers in charge of operation and control of activities on the flying deck, to note the course of the vessel, give signals and observe the approaching airplanes.

The two 54-foot masts, one each forward and aft, are made to telescope and disappear entirely below the flying deck. These are used for the main or long distance radio antennae, which are quickly stowed when the masts are housed. Raising or lowering the masts and antennae is done in the minimum of time. Antennae for short distance communication with shore stations or with other ships are suspended horizontally along the two sides of the ship from booms.

The navigating bridge on the bow will be noticed below the flying-off deck.

An elaborate system of gasoline and oil distribution has been installed. At each side of the ship near the aft mainmast respectively is a gasoline and lubricating oil station. Two of each on either side are provided further forward in close proximity to the palisade. A gas distributing pump is used to distribute the gasoline to four service tanks. At each service tank is a small service pump to further distribute the gasoline to the filling stations which are provided as above. The gasoline and oil to be stowed total 578 and 90 tons respectively. The oil is distributed in a manner similar to that of the gasoline. Provision is made for heating the main oil tanks and service tanks, the latter to a temperature of about 130 degrees F.

A platform for testing airplane engines with propellers in place will accommodate the largest airplane yet contemplated.

In the stern, just under the flying deck, is a pigeon loft and between it and the rear mainmast is a balloon-filling station for use with hydrogen or helium gas compressed in tanks.

The smoke pipes are arranged so as not to obstruct the flying-off deck and to keep smoke clear of the deck. This is accomplished by providing a short smoke stack on each side clear of the flying deck. The branches are interconnected so that the smoke may be discharged always on the lee side. One of the smoke pipes is arranged to hinge downward when it is considered necessary to discharge the smoke near the water, while the other can discharge the smoke downward through a water spray.

A flooding and sprinkling system is provided for airplane ammunition spaces and especial attention has been given to ventilation. A fire extinguishing system using steam for smothering is also provided for all hold compartments containing airplanes, gasoline tanks and oil tanks and compartments adjacent thereto. A water fire protection system also extends to other positions on the flying-off deck, with fire hose for the fire plugs while additional foam fire extinguishers are also considered necessary.

There are berths for the Captain and 9 officers of the ship, 35 flyer officers and 45 chief petty officers (aviation mechanics) and a crew of 229.

Around the flying-off deck is a rail supporting a life net, which is arranged to hinge down and outboard so that the deck can be readily cleared of all obstructions. This life net may be laid down in sections, clearing a part of the deck at a time, if desired. Portable stanchions and chains surround the elevator well when the elevator is down.

A masthead anemometer is electrically connected to the pilot house, to the flight officers' office or elsewhere. Voice tubes are arranged at suitable points.

Near the mainmast is a radio compass house, arranged to raise up from a position flush with the flying-off deck.

National Aeronautic Association Organized for the Advancement of American Aeronautics

THERE was organized and incorporated at Detroit, Mich., October 12-14, 1922, a new national body by 379 delegates from nine districts of the United States corresponding to the Army Corps Areas, under circumstances vastly more auspicious than any of the earlier efforts at a truly national organization.

It may be remembered that a number of years ago some of the more active members of the Aero Club of America, in co-operation with a number of dissatisfied affiliated clubs, attempted to form a national body, truly national in scope in spirit. This failed through the promotion by the Aero Club itself of an alleged national body, which infant later succumbed to some child's disease.

Just before the War, Howard E. Coffin interested himself in attempting to amalgamate the Aeronautic Society (New York) and the Aero Club of America into an Aeronautical Institute. Factions in the Aero Club at that time, later eliminated, prevented the fulfillment of this idea.

Just after the war, returning pilots formed the American Flying Club in New York which was joined with the Aero Club of America in 1920. In the Fall of 1921, during the flying meet at Omaha, there was formed the National Air Association, with Sidney D. Waldon as President and Rex L. Uden, of Cleveland, as Secretary.

This was a preliminary attempt to enlist all the aeronautic interests of the country into one big union and it was expected to complete the job at the second congress in 1922. During the ensuing months Colonel H. E. Hartney, secretary of the advance committee, organized an advance committee and, stirred up many cities to the formation of air boards. This advance committee was composed of five hundred enthusiasts, and of these an executive committee of thirty carried on the active work culminating in the convention just held during the flying race meet at Detroit.

It is assumed that eventually the national association would naturally become, in place of the Aero Club of America, the American member of the Federation Aeronautique Internationale. The Aero Club of America, practically since its inception, has been the body officially representing America in world aeronautics through its membership in the F. A. I.

The new Association was incorporated October 14th, 1922, as a non-profit, membership corporation, the papers being dispatched from Detroit to Hartford, Connecticut, by airplane and incorporation completed on the day of adjournment of the Congress. The control is in the hands of 23 governors, of whom each district is represented by two, with 5 governors-at-large.

Officers elected were as follows: Howard E. Coffin, President, Detroit, Mich., Bernard H. Mulvihill, Vice-President, Pittsburgh, Pa., Benjamin F. Castle, Treasurer, New York City. John B. Coleman, Recording Secretary, Sioux City, Ia.

Governors elected, two from each district, were as follows:

1st District

Porter Adams, 3 Commonwealth Ave., Boston, Mass.

Godfrey Cabot, 940 Old South Building, Boston, Mass.

2nd District

John Larkin, Jr. c/o Larkin Company, Buffalo, N. Y.

Maurice Cleary, 729 7th Ave., New York City.

3rd District

L. F. Sevier. Forbes & Craig Streets, Pittsburgh, Pa.

R. J. Walters, 600 Woodbaume Street, Baltimore, Md.

4th District

Van H. Burgin, 217 Healey Building, Atlanta, Ga.

L. Sevier, President Manufacturers Association, Birmingham, Ala.

5th District

Glenn L. Martin, 16800 St. Claire Avenue, Cleveland, Ohio.

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Dudley M. Outcault, Traction Building, Cincinnati, Ohio.
6th District
C. S. Rieman, 22 West Monroe Street, Chicago, Illinois.
Sidney D. Waldon, c/o Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.
7th District
Ralph Cram, 216 Main Street, Davenport, Ia.
H. F. Wehrle, 503 Railway Exchange, Kansas City, Mo.
8th District
Edgar G. Tobin, 207 Augusta St., San Antonio, Texas.
William F. Long, Stinson Field, San Antonio, Texas.
9th District
P. G. Johnston, 2432 North Broadway, Seattle, Wash.
C. H. Messer, 1803 West 3rd Ave., Spokane, Wash.

Personnel of the National Headquarters has been partially selected and installed in Washington and consists at present of men in charge of Administration, Contests and Foreign Relations, Membership, Finance Legislation and Publicity. Full membership on these various committees is now being selected by the President by and with the advice of the Governors.

Mr. H. E. Hartney has been appointed Acting General Manager.

The purposes of the new Association are briefly as follows:

(a) To maintain in the headquarters of the Association in Washington an agency capable of voicing a vigorous public opinion upon beneficial and essential legislation in all matters of aeronautics:

(b) To awaken and educate the public mind to the possibilities of aeronautics, both as a vital means of national defense and as a transportation factor in the commercial development of our country;

(c) To supply an impartial medium thru which the thought of all sections of the country may be collected, collated and harmonized into a national expression of opinion;

(d) To encourage and promote the study and advancement of the science of aeronautics, and to maintain an institution which will collect and disseminate general and technical data for the development of the industry;

(e) To sanction and actively supervise under license of the Federation Aeronautique International all contests, trials, competitions and other events involving aerial craft or apparatus, and to approve all records in connection therewith.

The Governors of the Aero Club of America and the Governors of the National Air Association, the two largest aeronautical bodies in America, have already voted to merge their membership into the new association and steps are now being taken to have other smaller aero clubs and flying organizations to take similar action.

There are approximately 160 aero clubs about the country.

Thursday Evening, Oct. 12

The first meeting was called to order with H. H. Emmons, president of the Detroit Board of Commerce in the Chair, with Col. H. E. Hartney as Temporary Sec. Mr. Emmons welcomed the visitors to the rooms of the Board of Commerce and to the City of Detroit.

He likened the proposed air association to the National Automobile Chamber of Commerce and told of its need "through the reckless and improper use of air equipment at the present time."

Mr. W. P. McCracken, of the American Bar Association and a flyer, was elected permanent Chairman of the Convention.

Col. H. E. Hartney was elected permanent Sec. of the Convention.

The nine districts into which the United States is divided by the association were called upon to report their committee members appointed by the districts in caucus, as follows:

Credentials
Resolutions
Legislation
Constitution
Finance
Membership
Nomination
Permanent Rules
District Constitution

Mr. Ruter W. Springer, a Pennsylvanian and a pioneer army chaplain in aeronautics said it had been suggested "that this organization was going to be run by one interest or another. We know that it is not, but in order that the outside world may know that, I offer this resolution:

Mr. Springer reads the resolution which states that the qualifications of all governors and officers in the new association shall be shown on all records.

The resolution to refer it to the committee in By-laws was not seconded.

Mr. Mitchell, of Georgia, invited the association to hold its 1924 meeting in Atlanta. No action taken. Chicago followed with a similar invitation.

D. M. Outcault, of Ohio, was called on to give a short review of the organization of the "National Air Ass'n" at Omaha in 1921, in the absence of its president Sidney D. Waldon, of the Packard Company.

Godfrey L. Cabot, a founder member of the Aero Club of America, told of the early history of this club, and told of the Aero Club's interest in seeing this new association take over the club's former functions which were those of merely a local organization.

Colonel H. E. Hartney, the organizer of the new body, was praised for his work from the Chair and called upon. He responded by crediting H. E. Coffin, V. P. of the Hudson Motor Car Co. of Detroit with being the man "who has 'held the bag' in bringing us all together........"

Founding of American Flying Club

Col. Hartney praised the early work of the Aero Club, told of the formation of the American Flying Club, by the pilots after the war and its amalgamation with the Aero Club. "Things were not quite properly organized and the result was it began to peter out. After a while somebody suggested that we clean up the whole situation and get a new——nationalize the Aero Club of America properly." He followed with an outline of what had been done up to the present by the Advance Committee of the Association.

The announcement was made that a charter had been prepared for incorporation under the laws of the State of Conn. Motion was carried that the chairmen of the nine districts represented at the convention sign the charter as incorporators and forward it to Conn. by airplane for filing so that the Association would be a legal entity before adjourning.

On adjournment for the evening and in the morning of the following day the various committees got to work.

Meeting of Friday, 13th

Committee on Rules and Procedure reported its work in the interim, and announced its rules of procedure for the meeting, which were adopted.

Membership Committee next reported. Its report was referred to the Com. on Constitution and By-Laws. A feature of the report, was an estimate of possible strength during the first year—19,000 members, by drawing on the Chambers of Commerce, Kiwanis, Lions and Rotary Clubs.

Credential Committee next reported. Three hundred seventy-nine was found to be the number of accredited delegates to the Convention.

Financial Policy

Late Col. B. F. Castle, Chairman of the Finance Committee reported.

He recommended extreme conservatism in the expenditure of funds during the first year, which funds would be derived from membership dues, which were estimated as follows:—

275	Life members @ $500 and int.	$6875
735	Sustaining members @ $50	36850
15400	Regular members @ $5	77000
—	Organization members @ $10-$150	not estimated
—	Air Board Organization members @ $25-$150	not estimated
2730	Junior members @ $2	5460
		$126,185

Municipal "air boards" may join the Association at from $25 to $150 a year according to a sliding population scale.

Of the membership dues, the Committee believed 75 per cent, or $94,638, should go to National Headquarters, the remainder going to the District Headquarters.

Official Publication

"Another possible source of revenue" considered by the Committee was "an official publication," but the Committee recommended by the Governors take steps to insure a circulation medium for the bulletins of the Association by a connection with some publication already existing, under which there would be neither revenue nor expense.

Estimated expenditures, as figured by the Committee, are as follows:—

Salary of General Manager		$5000
Expenses (traveling, entertainment)		2000
Office salaries		2600
Organizers expenses		3500
Incidentals		2000
Multigraphing		300
Office Supplies		300
Bills Payable Nov. 1, 1922		1500
Prizes		3000
Reserve	74438.75	37219.38
Less 50%	37219.37	
Total expenditures		57419.38
Plus permanent reserve		37219.37
		$94,638.75

It was recommended the Governors be permitted to spend 50% of the reserve for expansion work.

The Committee's report was adopted.

Admiral W. F. Fullam, retired, reported as Chairman, Legislative and Policies Committee, to the effect that until the Association was actually formed it was in no position to outline policies or to formulate bills.

Safety Code

Criticism of the 31 members of the committee of the Bureau of Standards and the S. A. E. engaged in planning a safety code was made parenthetically at

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this point. "This saftey code is being prepared by a body which is in no way representative of aeronautics," it was claimed by a delegate. "Twenty-five members are selected from government bodies, research organizations, that are not connected with the manufacture, or operation of either aircraft, equipment or their accessories."

Mr. William J. Hammer chairman, a pioneer in the Electrical world and an expert in aeronautics, and Ruter W. Springer, Sec., reported for the Resolutions Committee. These resolutions covered the following subjects:

National policy (carried).

Urging of federal legislation for regulation civil aeronautics (carried)

Licenses for pilots (resolution laid on table)

Disapproval of Hull bill (H. R. 10967) providing for aeronautic material to be constructed in government plants. (Tabled as too drastic at this time). Endorsement of plan by which civilian contractors carry the mails. (carried).

Appreciation of the remarkable achievements of the U. S. Air Mail by the Post Office Department. (carried).

Appointment of Committee on Aeronautical Meteorology in the Association (Tabled).

Urging of Congress to make adequate appropriations for experimentation and development for military and naval aeronautics. (carried).

Committee on Constitution and By-Laws reported through Dudley M. Outcault of Cincinnati, Constitution and By-laws were read through paragraph by paragraph and adopted. Copies of these may be had upon application to the headquarters of the Association.

"Hazardous Flying"

After a discussion of a resolution putting the Association on record against wing walking and similar useless exhibition stunts, the general idea was approved in a motion.

Motion that its various engineering societies be requested to lend their active support to the work of the National Aeronautic Association was carried.

Motion thanking the Mayor of Detroit for the hospitality of the city was carried. A similar one was approved with respect to the Chamber of Commerce and the Detroit Aviation Society.

Other motions of similar nature were passed respecting the War Department, Navy Dept., Marine Corps, Post Office, Department of Commerce, N. A. C. A. State Police, and the Advance Committee on Organization, especially ex-Colonel Hartney, Sec. pro tem.

Mr. G. A, Shoemaker reported for Com. on District Constitution and By-laws in which it was recommended the districts be given the greatest powers of self government, their Constitutions and by-laws to be submitted to the Board of Governors of the national body for approval before adoption. (Carried).

Floyd J. Logan presented a number of practical suggestions for contests in 1923.

James A. Meissner, ex-major in the Air Service, an "ace", offered a resolution urging the Association exert every effort to stimulate organization of National Guard squadrons. (Carried).

Officers

John B. Coleman, of Sioux City, Ia., spoke for the Committee on Nominations and reported the candidates following were elected:

Howard E. Coffin, Detroit, Pres.

Barney H. Mulvihill, Pittsburgh, Pa., Vice-President.

Benj. F. Castle, New York, Treas.

John B. Coleman, Sioux City, Ia., Recording Sec.

Nominations for two members for the Board of Governors, one of which is to be designated as the District Vice President, were next in order and presented as previously mentioned.

After considerable discussion of Glenn Martin the nominations were passed. Mr. A. M. Harris of Cleveland, while expressing the highest regard for Martin, believed the members of the convention "will agree that it is not the thing to put any flavor of a manufacturer or aircraft corporation on to the results of this convention. There are a lot of people throughout the United States affiliated with outer organizations who have it decidedly in for the manufacturer or aircraft organizations......I believe the people at large consider him (Martin) a member of the Manufacturers Aircraft Ass'n......and I think the effect on this result from this convention would not be what we would all desire it to be......I think the best interests of Aeronautics would be best served by Mr. Martin not serving as a governor in the beginning of this Association. I thank you!"

The convention then adjourned.

N.A.C.A. Multiple Manometer

JUST what an airplane does in free flight, the degree of its stability or instability along its three axes; the position of the ailerons, elevator or rudder during any maneuver, such as a loop, spin, turn, landing or take-off; the force necessary in operating controls; the forces acting on controls in maneuvers; examination and recording of the air flow; the illustration of the properties of airplanes and the visualization of their behavior; the demonstration of the stresses undergone by an airplane in straight and acrobatic flight and how long these stresses last: and the visualization, comparison and measurement of the ability of pilots, all are recorded photographically by the instruments developed by the technical staff of the National Advisory Committee for Aeronautics. Following is the first of a series on these new instruments.

The latest of the series of novel and revealing recording instruments of the National Advisory Committee for Aeronautics for aircraft in flight maneuvers is the Multiple Manometer, which records simultaneously on a photographic film pressures at 30 different points on wing, tail, or aileron surfalls.

The instrument is placed in the observver's cockpit(Fig. 3) of a two-seater. From 60 openings 60 tubes lead to 30 capsules inserted in the two sides of the surface to be tested. The Control position recorder and the accelerometer are in operation simultaneously with the manometer.

*For complete reports on pressure distribution, obtain Nos. 118, 148, 149.

With this instrument it is possible to record pressures up to plus or minus 45 lbs. per sq. ft. for a period up to 75 secs. with the present adjustment of the capsules. Thirty differential pressures can be recorded simultaneously by this apparatus.

The principal part of the device consists of 30 separate pressure "capsules" Fig. 1 and 2. arranged around the outside of a cylindrical aluminum casting, in three rows of ten. At the center of the bottom of the case is an electric bulb with a straight vertical filament. This bulb is enclosed in a chamber having a horizontal annular slit .004 inches in width so that a horizontal sheet of light is spread out in all directions. This light is intercepted when it reaches the inside of the case by 10 long prisms which send it directly upward to 30 small prisms, which, in turn, transmit the light through lenses to a small mirror on each capsule. The beam of light is then finally reflected back through the same lens, which focuses it sharply on a film.

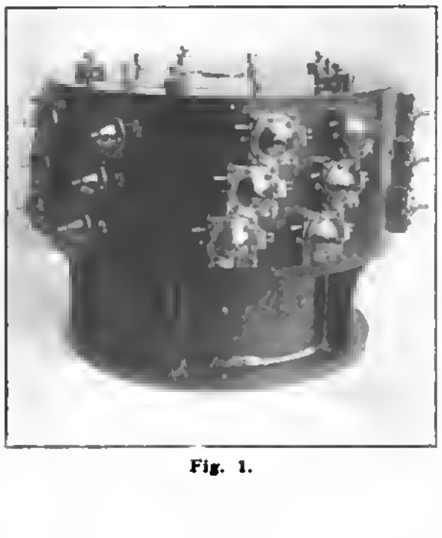

Fig. 1.

This film has a width of 4½ inches and is wound on a drum 6 inches in diameter. The film is mounted in a light tight case which can be lowered inside of the instrument between the rows of prisms and the driving mechanism. A rotary shutter opens 30 slits for the entrance of the light beam after the film drum is in place.

The film drum is turned through 1/10th revolution by a constant speed electric motor driving through a double worm reduction gear. The speed is regulated by a centrifugal governor with electric contacts which cut in and out a resistance. The speed remains constant within one per cent for considerable changes of either voltage or load.

The pressure capsule consists of a brass case divided into two chambers by a hard brass diaphragm with a connection for pressure in either part. The movement of the diaphragm rotates a small plain mirror which is mounted on pivots and in this

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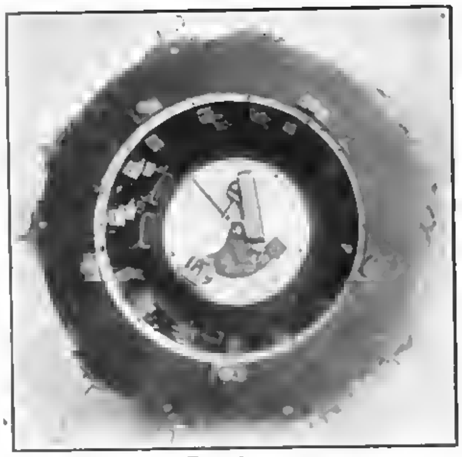

Fig. 2.

manner causes the light beam to move over the film and give the record. The moving system of the capsule is sufficiently light and well balanced to prevent any acceleration from affecting the pressure readings.

Operation

To make a record, tubes are connected to the capsules in such a manner that the pressure side is connected to the back of the capsule and the corresponding suction tube to the side of the capsule. To operate the driving motor and lamp a source of 8 volts d. c. is required. Binding posts for the driving motor and for the lamp are on the outside of the instrument. A suitable switch is conveniently placed so that the pilot may start the record at any desired instant. When the drum is in place and the shutter is opened the instrument is ready to operate by closing the switch.

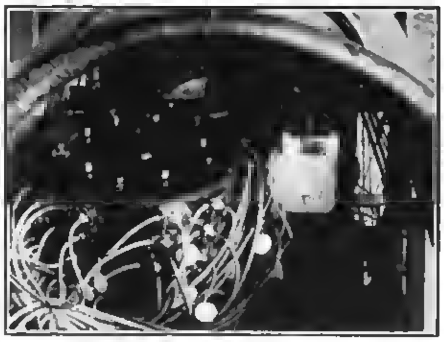

Fig. 3.

The film drum is loaded in a dark room with a fast bromide paper, or its equivalent, with the sensitized part toward the outside. The shutter is closed when the drum is out of the instrument and only opened when ready for the run.

If a longer record is desired, the drum can be made to move at slower speed, by tightening the spring on the governor a slight amount. If a much larger change is desired, stiffer springs may be substituted. The drum speed can also be changed by changing the driving gears.

Pressures on Rudder and Fin

Using the manometer, an investigation has been made by the N.A.C.A. of the pressure distribution over the rudder and fin of a J N 4H in straight flight and in acrobatics (Report No. 149).

The results obtained from this investigation enable designers to know much more closely than hitherto the nature and magnitude of the loads acting on the rudder and fin of an airplane. Contrary to previous beliefs, the loading on the vertical surfaces is generally greater than on the horizontal ones.

It is recommended that in sand-load tests a unit load of 2 pounds per square foot be used, this unit being multiplied by the designed load factor of the wings to give the maximum load on the rudder and fin. The center of gravity of the load may be taken vertically at the same level as the center of gravity of the area, while the fore and aft distribution should be as shown in Figure 10. Care should be taken in all designs to make the leading edge of the fin stiff, as it is believed that nearly all tail surface failures are due to vibration.

Elevator and Stabilizer Pressures

Another series of tests was made, recording pressures on the horizontal tail surfaces (Report No. 148) in spins, dives, etc.

The results of these tests show that tail loads can not be computed from model tests. This is due to the fact that the airplane begins to rotate as soon as the elevator begins to be pulled up, thus relieving the load before it can build up. The tail load necessary to produce an angular acceleration is small compared with that necessary to balance the pitching moment of the wings.

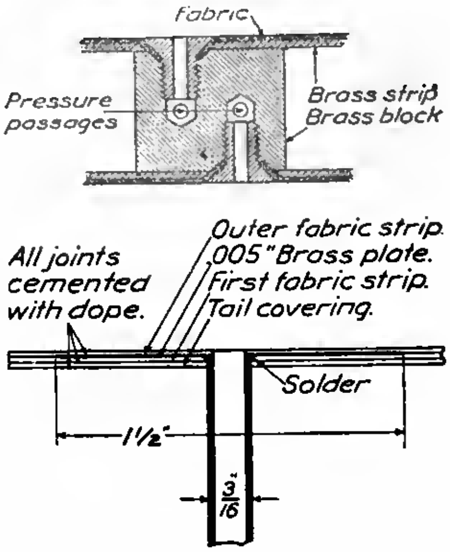

Fig. 4.

The method of calculation based on the wing pitching moments and the angular acceleration gives the tail loads closely in any maneuver where the speed, normal and angular acceleration, and center of gravity position are approximately known.

It seems evident from these tests that the strength of fuselage and tail surfaces on the present machines is excessive, and that a considerable saving in weight can be made.

Pressures on the Wing

Hills and valleys of pressures are shown by the photograph (Fig. 5) of a built-up model illustrating the varying pressures on a square-tip wing. A "map" of the same outer section of a wing shows by contour lines the various pressure differences over the surface (Fig. 6).

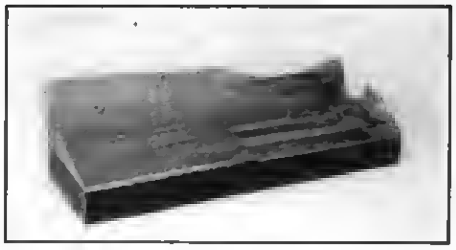

Fig. 5.

Fakir Fuel Pump

IN DESIGNING the Fakir fuel pump, the fundamental idea was to obtain a simple and reliable method of conveying the fuel from a low tank to the carburetor, with the avoidance of the faults of all former methods and the simultaneous warming of the fuel by means of the heat of compression generated.

The principle of the Fakir fuel pump rests on the well-known principle of the diaphragm pump, which must however be suitably adapted to the present purpose. Figs. 1 and 2 are drawings of the pump. Inside the housing (formed by the circular wall A, the front wall A_1, and the rear wall A_2), there is a hollow body Q cast in one piece with walls A and A_1, containing the inter-connected horizontal and a vertical channel Q_1 and Q_2. The channel Q_1 is open toward the diaphragm and contains the spring K which presses against the diaphragm. The channel Q_2 is connected with the inlet D_1 and above into the pump housing. The intake valve F and the pressure valve G are respectively below and above the channel Q_1. The seats of these valves are shaped out of the tube connections F_1 and G_1 which communicate with the channel Q_2. The hollow body Q also contains a second horizontal channel Q_3, which lies below the intake valve F and forms a connection between the vertical channel Q_2 and the space inside the pump housing through the return valve P (for the back flow). The latter is held shut by a spring P_1 which is coiled about a holt S. The holt and spring lie in a cross bore F_2 of the tube F_1. The bolt S is screwed into the wall A and its outer end is covered by a screw cap S_1. Below the return valve, there is a non-return or check valve T which, like the inlet valve, is provided with a strainer to keep out any dirt there may be in the fuel. The diaphragm lies between the wall A and the cover J which is clamped on to a special shaped base. This base, which is formed hy the wall A_1, is so made that the diaphragm can only yield within suitable limits, without danger or rupture or fatigue, and is then supported by the hase so

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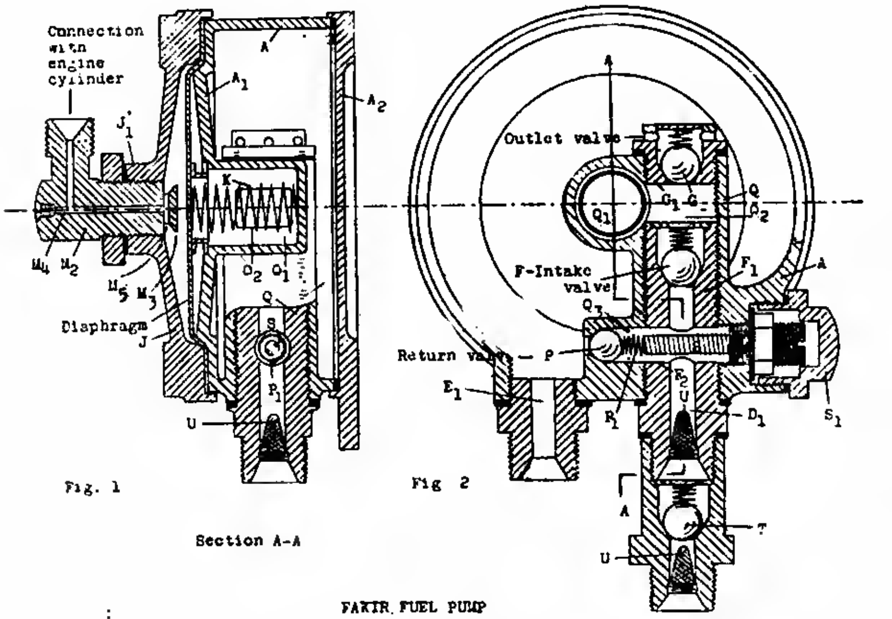

FAKIR FUEL PUMP

that the high cylinder pressure cannot hurt it. The distance of oscillation in either direction and the pressure of the diaphragm spring have been adjusted by many experiments, so as to come within the elasticity of the metal diaphragm and prevent the possibility of fatigue. For the protection of the diaphragm from the spring, there is a pressure plate on the end of the latter. The gas-pressure space, inclosed between the diaphragm and the cover, is (through the elbow M_2 and the channel M_4, which opens into the gas space through the cross channel M_5) in direct communication with the engine cylinder.

The Fakir fuel pump operates as follows: The pressure variations in the engine cylinder produce oscillations of the diaphragm. During the period of diminished pressure in the engine cylinder, the oscillation of the diaphragm (supported by the force of the spring behind it) draws fuel from the tank, which is then (during the period of compression, explosion and exhaust) driven out again. This process, which is continuously repeated all the time the engine is running, pumps considerably more fuel than the engine requires. The excess fuel must therefore be rendered harmless. This is accomplished by the automatic flow of the excess fuel (which does not run through the outlet E_1 to the carburetor) back through the return valve P into the fuel column under the intake valve F. In order to prevent this action from causing any return flow of the fuel column into the fuel tank, the check valve T is introduced. The pump therefore always delivers to the carburetor only the quantity of fuel required at the time by the engine, while the excess fuel circulates inside the pump. Now, since heat is produced by compression, this circulating fuel is highly heated by coming in contact with the thin metal diaphragm. The fuel is still further heated by the heat conduction of the metal pipe connecting the pump with the engine cylinder, in which pipe hot gases, oil and other fluid residues of the explosions oscillate to and fro. After the engine has been running a short time, these fluid residues fill up the gas space (between the diaphragm and over J) and parts of the delivery pipe, so that, in practice, no increase in the volume of the clearance space takes place in the engine. By suitably adjusting the size and length of the delivery tube from the pump to the engine cylinder, it is possible (within certain limits) to give the fuel any desired amount of preliminary heating and, even for low initial temperatures of the fuel in the tank, obtain final temperatures of 30-35°C in the float chamber of the carburetor. Experience has shown that engines with fuel warmed in this manner can use cold air even in winter and still develop a high degree of efficiency, as well as be able to utilize difficulty volatile fuel.

The Fakir fuel pump can be installed anywhere between the fuel tank and the carburetor, since the flow of fuel to the pump does not depend on gravity, but on adjustable pressure. It may be further said that it is proof against all shocks and changes of inclination on motor vehicles of all kinds (including water and air craft), since it has no movable parts aside from the four valve balls which are held by springs. The chances of its getting out of order are therefore reduced to a minimum. It requires no attention, aside from seeing that the piping is tight, which is an essential condition for any pump.

Paragon Adjustable and Reversible Propeller

THE Paragon adjustable and reversible aircraft propeller, the invention of Spencer Heath, the pioneer propellor maker, made its official debut on October 11 at Bolling Field in a demonstration to representatives of the offices of the Chief of Air Service, Chief of the Bureau of Aeronautics of the Navy, of the Air Mail, the Press and motion picture news associations.

The automobile truck trailer, upon which the propeller and a 150 h. p. Wright-Hispano engine was mounted, was made to maneuver about Bolling Field at the will of the operator.

What new stunts may now be evolved with the aid of a reversing propeller may be left to the imagination. One can easily imagine the two-seater of the future suddenly reversing into a stall and taking a shot from underneath at his surprised adversary overhead. The device is to the aircraft what change speed gears are to the automobile.

It comprises, in short, a system of special blades and a mechanism for varying the pitch of the blades from zero to 360 degrees, while in flight or otherwise.

The invention is being marketed by Paragon Engineers, Inc., 243 E. Hamburg St., Baltimore, Md.

By adjusting the pitch, either before starting or while the engine is running, to a less than normal angle, the engine is allowed to pick up speed and deliver its maximum power which is necessary in taking-off with a heavier load than the same airplane could otherwise normally carry. Upon reaching the desired altitude, the pitch may be increased by the pressure of a finger on a knob on the dash and the engine run at its most economical speed, still with the possibility of increased speed range should occasion demand. As the load is lessened by consumption of gasoline on a long distanced flight, the pitch may be still further increased.

In landing, the pitch of the screw may be changed to any degree in the opposite direction, or "reversed" just before the instant of contact with the ground and the plane brought to a stop in the very shortest space, obviating entirely any prepared ground system of slowing up the machine.

This is a feature of especial moment to naval aeronautics where the shortest run after landing is a prime necessity, owing to the confined space which may be available on a ship's deck or even on that of an airplane carrier ship, like the "Langley."

For the airship, the same advantages of economy are apparent while the reversible attribute exactly doubles maneuverability in docking, whether shed or mooring mast is employed.

It is even possible that the adjustable and reversible propeller may cause rapid advancement in the helicopter, or direct-lift, machine.

It was long realized that the variable pitch and reversible propeller was a development which would travel side by side with supercharged and multi-engined aircraft.

This new design now avoids the objectionable features ordinarily considered with respect to possibilities in this direction.

In the Heath propeller there has been achieved:

(a.) Elimination of continuously running gears, collars or bearings in the pitch control mechanism.

(b.) The use in flight of engine power in place of manual labor in changing the blade angle.

(c.) The absence of any structural limitation to the range of blade angles available as well as the limiting of the blade travel between any two predetermined extreme positions.

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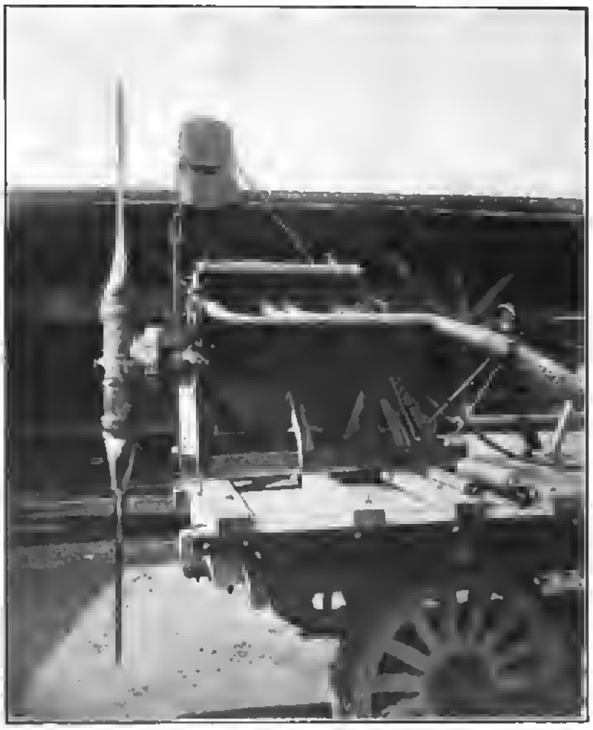

(d.) Continuous indication on the instrument board of the blade position.

(e.) Automatic throttling of the engine while the propeller is passing through the position of neutral pitch.

General Description of Propeller

The two wooden or steel blades are fastened into steel sleeves which in turn are held in a steel hub, the centrifugal forces being taken on ball thrusts and torsional and axial forces on plain bearings.

The method of fixing the wooden blades into the steel sleeves is noteworthy. The butt end of each blade is tapered outwardly at a small angle as shown in Fig. 1, and the surrounding collar is split so that it may be first sprung over the butt and then compressed upon the taper.

Pitch Changing Mechanism

The pitch changing mechanism is operated through the application of a braking force to either one of a pair of small brake drums surrounding the engine crankshaft and normally rotating with it. The elementary principle is shown by diagram in Fig. 2, which represents a brake drum connected through a gear train to the individual blades of the propeller.

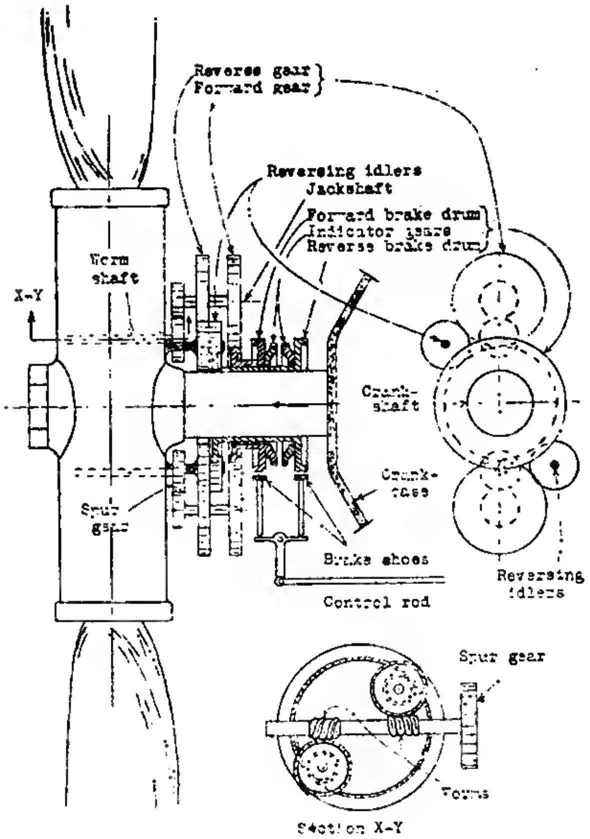

Fig. 3. Pitch changing gear train.

Fig. 1. Split steel sleeve compressed about butt end of propeller blade.

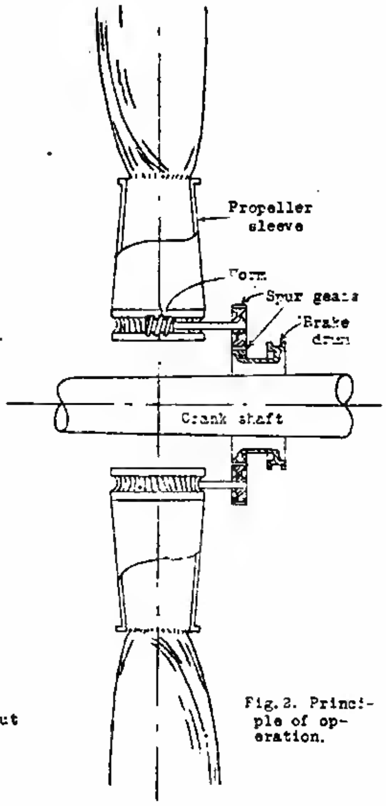

Fig. 2. Principle of operation.

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to revolve at crankshaft speed, all the gears will be stationary relative to the propeller and that the pitch angle will remain constant. If, on the contrary, the brake drum is held stationary the gear train will be set into action and the pitch angle of the blade will undergo a continuous change until the brake drum is released.

In order to change the blade angle in the reverse direction a second brake drum is used, connecting to the worm shaft through an idler which serves to reverse the direction of rotation of the worm shaft. It should be noted that during normal flying none of these gears are operative and that the blades are locked in position by the non-reversible features of the worm and the friction of the connected parts.

The actual construction of the pitch changing mechanism is more fully indicated in Fig. 3. The brakes are applied through leather faced shoes operated from the pilot's seat by a light push and pull knob attaching to a brake lever mounted on the drum housing. A small hand crank is provided by which the pitch can be changed while the engine is not running.

Blade Position Indicator

The angular setting of the propeller blades at any instant is a function of the relative motion which has taken place between the two brake drums. The indicating mechanism is therefore operated by gearing from the two brake drums which conveys differential motion to the indicating pointer and the throttling and pitch limiting cams. As long as the two brake drums revolve both at crankshaft speed the indicating hand remains stationary but if either of them is retarded an angular motion is shown on the indicator equal to that experienced by the blades themselves.

Automatic Throttle Control

The mechanical throttle is provided with springs in both directions so that the pilot can at any time by applying a force on the throttle greater than the initial tension in the springs substitute manual for automatic control.

Pitch Limiting Mechanism

In the pitch limiting mechanism the control knob normally connects to the brake levers direct, a push increasing and a pull decreasing the pitch. If the control button is held in either operating position until the limiting position of the propeller blade is reached the cam trips a latch plate and renders the control inoperative in that direction while leaving it ready for use in reversing the direction of propeller blade motion.

Demonstration Under Power

To show the action under power the propeller has been installed on a 150 HP. Hispano-Suiza engine mounted with gasoline tank, observers' seats, etc., on a trailer truck weighing about two tons which is free to roll on the ground. In the demonstrations thus far made the device is put through its entire range of performance, which includes disconnecting the pitch limiting mechanism so that the blade angles are controlled throughout a complete revolution of 360 degrees, both forward and reverse.

With the engine turning at 1500 r. p. m., the angular change from full speed ahead to full speed astern is accomplished in about 3-1/3 seconds.

Navy's Aerial Lighthouse

AN ACETYLENE gas aerial light house has recently been installed by the Navy at the air station at Hampton Roads, Va., and another has been ordered by the Army Air Service for observation at McCook Field. It is not improbable that a line of these may be established on the "model airway" between Washington and Dayton, at the terminals and on the highest ridges in Cumberland, Md., Pt. Marion, Pa., Moundsville, W. Va., Zalesville and Columbus, the vicinity of Charlestown, W. V., Ohio.

The Post Office is also interested in a system of lighthouses for the step between Chicago and Cheyenne and another prospect is with the Forest Service.

The Aeronautical light of the American Gasaccumulator Co., as bought by the Navy and Army is a mantle light with flasher of the type similar to the same make already in service at the Croydon aerodrome in England, where the light has, in that latitude, an average visibility of 32 miles horizontally and from 2 to 4 miles vertically, but more powerful.

These lights are entirely automatic in operation. They may be placed in almost any inaccessible position which may be the most suitable from a navigational point of view and then left unattended for periods up to 12 months, if desired. The flashing apparatus can be adjusted to give any desired grouping of flashes. When desired, the lights may be fitted with a "Sun valve," which lights and extinguishes the beacon automatically at darkness and dawn from a pilot light which keeps burning.

The optical elements are divided into two sections. The top section consists of half a dioptic drum lens and serves the purpose of projecting a very powerful light slightly above the horizontal plane. The lower elements are catadioptic rings, so arranged as to distribute the light falling upon them at suitable angles above the horizontal plane.

An aviator approaching the light at an altitude not exceeding 8000 feet remains within the area covered by the main beam until he is within about 8 miles of the light. At that range the light source

A. G. A. Light used at Croydon, England.

The A. G. A. Lighthouse at Croydon.

The Aerial Lighthouse at Hampton Roads, Virginia.

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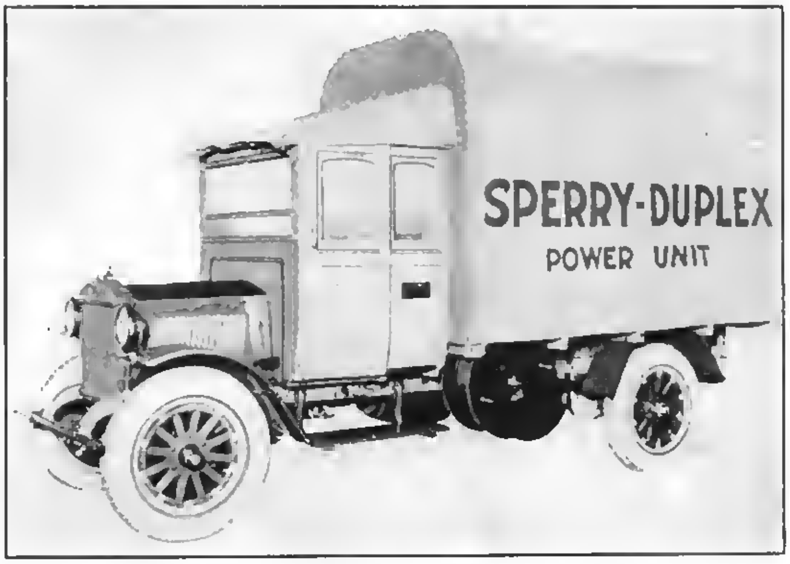
itself is easily discernible. The flashing can be adjusted to give any variation of light and dark periods.

It is argued that existing marine lighthouses and beacons are so designed that the arrangements of optics in them is such as to give a light of maximum power in certain closely defined directions, only, and the vertical angle of dispersion of the light is generally such that it will only be visible to an aircraft pilot through a very small area and at a long distance from the light.

For night flying it is desirable to have a light clearly visible within its range from any point in the upper atmosphere and, in addition, it must have a perfectly clear and precise light charaeter. It is urged that a light signal must be completely repeated not less than from 6 to 10 times while a pilot is approaching it from a distance of 15 miles. At 90 m.p.h., this distance would be covered in 10 minutes and, therefore, a signal having a total period of 35 seconds will be repeated 17 times. In smaller sizes these lights can be furnished in portable form.

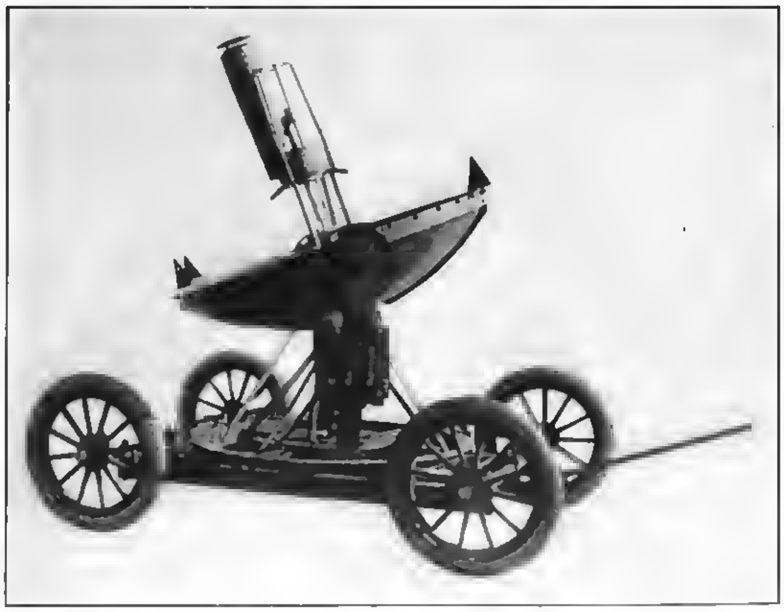
A beacon of the searchlight type, and portable, has been developed by the Sperry Gyroscope Co. The searchlights which may be of 36" or 44" drum type, high intensity, or 60" open type, are mounted on mobile carriages. An automobile truck contains the power unit for operation in the field.



The Sperry Portable Power Unit

In a recent series of tests, one run was made from Brooklyn, N. Y., to the Army's experiment station at McCook Field, Dayton, O., 697 miles.

On the night trip of the Army nonrigid C2 from Washington to New York and return to Aberdeen, in August last, the Army airship pilots were given their first experience with the night operation of airships with the aid of high power ground lighting. A Sperry searchlight was stationed in New York harbor and during the period of the flight swept the sky in a circle at an angle of about 15 degrees from the horizon. The heavy fog which obscured all the lights of the city from the circling airship 500 feet above Miss Liberty was penetrated by the searchlight's beams which were seen after leaving New York on the return trip until the ship had passed out of Upper New York Bay. It is believed that such a beam can be seen 20 miles in all weather and 75 or 100 miles without a fog, from as low an altitude as 1,000 feet The rays of such a light are blinding when near, but the aircraft pilot is easily able to see buildings or other landmarks when flashed upon, from considerable distances.


The Sperry Portable Searchlight

The Prediction of Propeller Characteristics from the Blade Element Analysis

By William H. Miller, M. Sa., Curtiss Aeroplane & Motion Corporation

Continued from October issue

IT SHOULD be borne in mind that the formulas established for the approximate determination of the slip angle of the propulsive airscrew should not be applied to standing thrust conditions. For the static case, θ is in general of such magnitude that the equation

$$\tfrac{1}{2}\, m\, C_L = \frac{\sin \theta \tan \theta}{1 - \tan \theta \tan \gamma}$$

must be solved. This is usually impossible unless $\tan \gamma$ and C_L are expressed as functions of the angle of attack. (For example, C_L and C_D may be expressed, approximately, by linear and quadratic functions of the angle of attack.) Even

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then the solution must be performed graphically. It has been the experience of the writer in designing wind tunnel propellers, that the approximation

$$\frac{1}{2}\, m\, C_L = \sin \Theta \tan \Theta$$

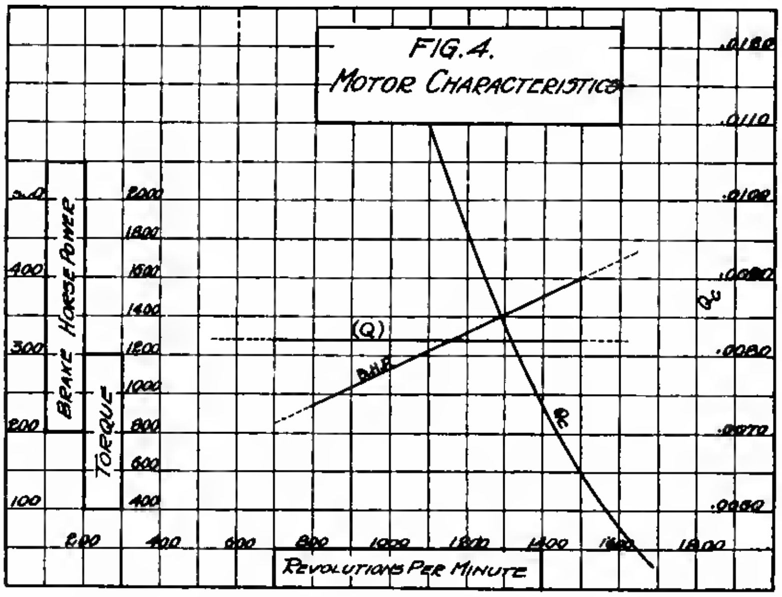
can be used. The general method of designing a wind tunnel fan will be made the subject of a later article.

Before beginning the solution of a problem illustrating the use of the formulas obtained thus far, we will state, briefly, the usual method of combining the engine and propeller characteristics. If we have given the engine characteristics, torque and brake horsepower versus revolutions, and the propeller curves, thrust and torque coefficients versus J, the procedure is as follows: Reduce the engine and propeller data to the same units. Then re-plot the engine torque curve as

$$\frac{Q_m}{\rho\, n^2 D^5} \quad \text{versus } n$$

for the particular value of ρ considered. Since the motor and propeller torques are equal

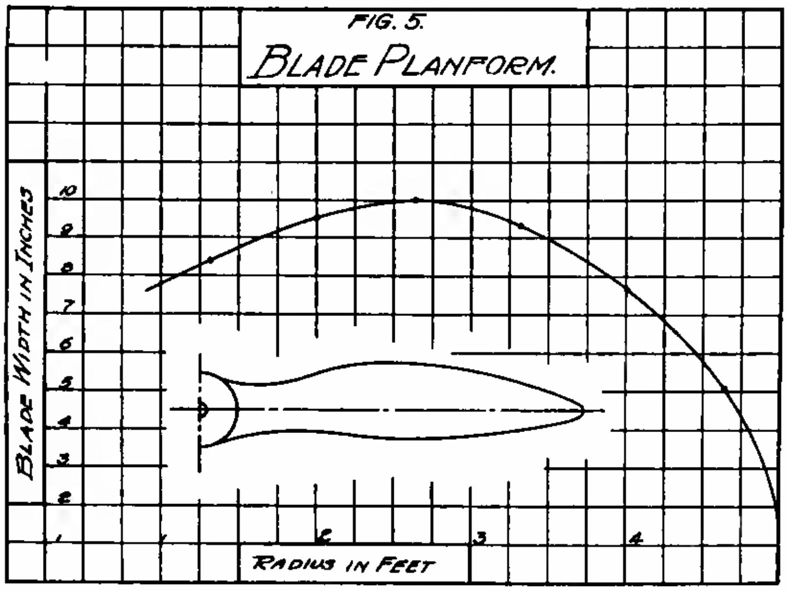
$$\frac{Q_m}{\rho\, n^2 D^5} = \frac{Q}{\rho\, n^2 D^5} = Q_c$$



Thus one can find the corresponding values of n and J from the propeller torque coefficient curve and the re-plotted motor torque curve. Multiplying the value of J thus obtained by the corresponding value of (nD) we obtain V. Again having given the efficiency, η, of the propeller as a function of J, we know the corresponding values of n and J, and Pm from the motor and propeller curves. Then multiplying this value of Pm by η, we obtain the useful power Pu. The following performance curves of the engine propeller group may then be plotted:

1. Brake H.P. vs. velocity of advance.
2. Useful " " " " "
3. Revolutions " " " "
4. Prop. Efficiency " " "

One important point in conjunction with design must be noted: It is necessary to estimate, on first trial, the maximum blade width as accurately as possible in order that, for a given planform, the computed brake power will come out within a few percent of the desired power to be absorbed. This is due to the fact that the required blade angle (being a function of the slip angle Θ) is a function of the blade width, since the formulas for Θ contain the breadth ratio, $m = \dfrac{Nc}{2 \pi r}$.



Numerical Example.

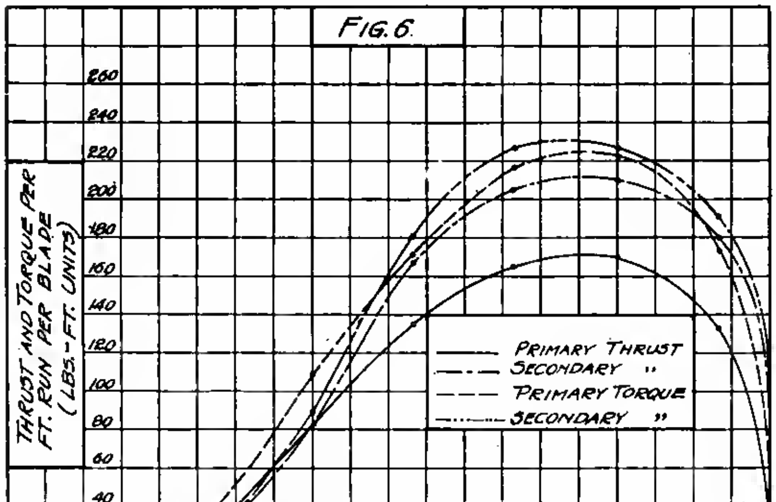
Primary Data:—

Brake horsepower: 400
Standard Density (.07608 lbs./cu. ft.)
Velocity 120 m.p.h.
Revolutions per minute: 1700
Diameter: 10 ft.
Angle of attack 1°.

The motor characteristics over the working range are given in Fig. 4. On the same sheet is plotted the curve

$$\frac{Q_m}{.07608 \times n^2 \times D^5} \quad \text{versus } n$$

The blade planform is shown in Fig. 5, and the section thickness ratios and aerodynamic characteristics, together with the detailed evaluation of the thrust and torque differentials for primary conditions are given in Table III, and Fig. 6. Integration of the thrust and torque curves for primary



conditions gave
B.H.P. = 401 Qcl = .00650
U.H.P. ≐ 300
Eff. = 75% (approx.) Tcl = .049

The detailed evaluation of thrust and torque for secondary conditions is given in Table IV and Fig. 6. Secondary conditions gave the following values; for V = 100 ft./sec., and n = 25 rev./sec.,

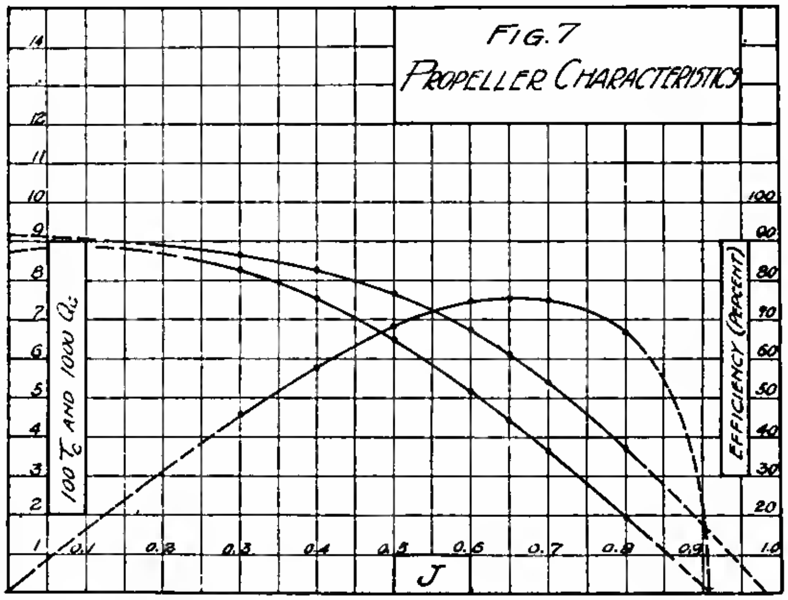
B.H.P. = 350 Qc_2 = .00827
U.H.P. = 202
Eff. = 58% Tc_2 = .075

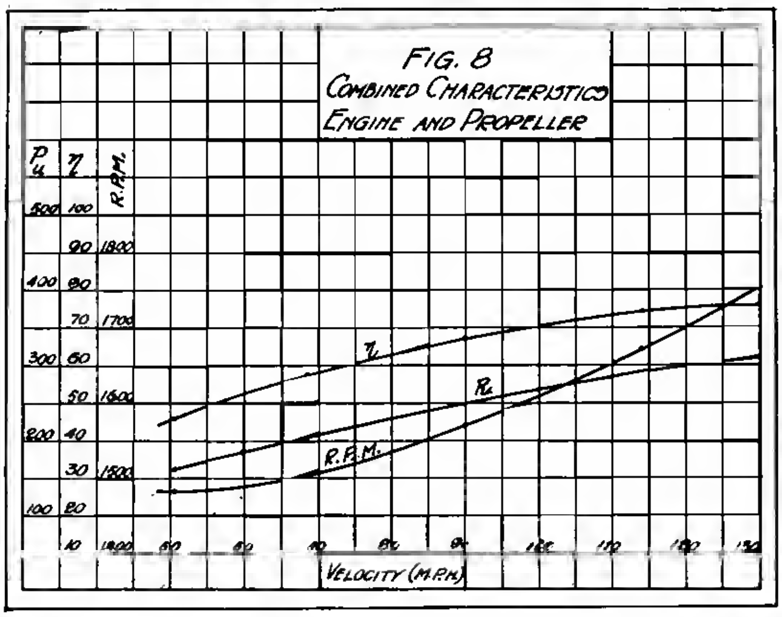
Formulas (8) then gave for the constants a, b, c, and d in the equations of the characteristics of the propeller:

a = .09360 b = .1160
c = .00892 d = .0101

The propeller thrust and torque coefficients may therefore be expressed by the following equations:

$$Tc = .0936 - .116\ J^2$$
$$Qc = .00892 - .0101\ J^3$$





The propeller efficiency was found by means of formula (9) and plotted with Tc and Qc against J in Fig. 7. The steps in the evaluation of the useful power are given in Fig. 8, where it is seen that the maximum efficiency, 76%, occurs at about 130 m.p.h., outside the working range. The latter point is interesting to note. The advance per revolution prescribed by the primary conditions may not in general give the highest efficiency it is possible to attain with the propeller. However, once the characteristics of a family of similar propellers have been found, one can apply similitude laws to determine the optimum diameter for given conditions.

TABLE III

Evaluation of Thrust and Torque for Primary Conditions:

Station	1	2	3	4	5	6
Radius	1.33′	2.00′	2.67′	3.33′	4.00′	4.67′
2 — rn	236	356	475	591	711	830
tan Ø	.746	.495	.371	.298	.247	.212
cos Ø	.8016	.8962	.9376	.9583	.9709	.9767
Ø	36° 42′	26° 20′	20° 21′	16° 36′	13° 52′	11° 58′
c	.700	.792	.835	.775	.635	.421
m	.167	.126	.099	.074	.050	.029
CL	.275	.340	.300	.255	.220	.193
L/D	10.50	15.00	17.00	18.20	19.23	20.20
—	5° 26′	3° 49′	3° 22′	3° 9′	2° 59′	2° 50′
O	2° 7′	2° 34′	2° 14′	1° 45′	1° 13′	0° 44′
Z′	38° 50′	28° 54′	22° 35′	18° 21′	15° 5′	12° 42′
tan Ø′	.8050	.5520	.4159	.3317	.2695	.2254
sin Ø′	.6271	.4833	.3840	.3148	20.02	21.98
Ø′ + J	44° 15′	32° 43,	25° 57′	21° 30′	18° 4′	15° 33′
tan (Ø′ + J)	.9747	.6424	.4867	.3939	.3262	.2783
cos (Ø′ + J)	.7161	.8414	.8992	.9304	.9507	.9634
V (1 + ½a)	184	191	194	194	191	186
aV	16	30	36	36	30	20
2 — rn b	15.5	19.3	17.5	14.2	9.8	5.5
D	39.8°	29.9°	23.6°	19.4°	16.1°	13.7°
dT/dr	28.0	84.5	136.0	165.0	170.0	133.0
dQ/dR	36.2	109.0	172.0	216.0	222.0	173.0

Conclusions.

While it appears that the working characteristics of a propeller can be predicted to a fair degree of accuracy by means of the conventional blade element method, as developed fundamentally by Drzewiecki, Riach, Bothezat, and others, the theory will never be exact so long as uncorrected aerofoil characteristics, as determined in the wind tunnel, are applied in practise. The vortex theory offers at present the greatest possibilities as regards the development of a really accurate method.

The present article was prepared primarily for the interest of those who desire a simple method of approximating the characteristics of an airscrew over the working range.

(See page 598 for table IV and table V).

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Standardization and Aerodynamics

By William Knight, M. E.

ON JUNE 20th, 1921, I published an article in the AERIAL AGE under the title "Standardization and Aerodynamics" in which the suggestion was made of the desirability of calling a Congress of representatives of leading aerodynamic laboratories, without any discrimination between former allies and former enemies, for the purpose of arriving at an understanding as to the coördination of laboratory work in aerodynamics leading to a better utilization of Scientific research knowledge in aeronautics in the interest of all concerned in this matter.

In that article I presented a number of suggestions contained in a report of mine to the National Advisory Committee for Aeronautics which I had submitted to that organization in 1919 while I was representing that Committee in Europe.

The suggestions contained in that report can be summarized as follows:—

The appointed task of the proposed Congress of representatives of aeronautical laboratories and other aeronautical technical and Scientific organizations should be:—

1st—To agree on a number of tests to be made in existing wind tunnels both in this country and in Europe on some standard model, or models, with a view of determining the influence of local conditions prevailing in each wind tunnel (method of attachment of the model to the forces measuring device, dimensions of model as compared to the dimensions of the wind channel, state of turbulence of the air flow, etc.) and the necessary corrections to introduce into the calculations of the results obtained in each wind tunnel on the same model in order to bring such results in line with those obtained in other wind tunnels.

At present such a divergency exists between experimental results obtained in various wind tunnels, when no such divergency should exist, that the confidence of aircraft manufacturers and designers in the usefulness of wind tunnel research work is badly shaken. Such a dangerous situation could be corrected with the organized coöperation of scientists and technical men engaged in research work in aeronautics who know better than anybody else where the trouble is to be found and who, furthermore, are eager to coöperate with each other, if the initiative is taken by some responsible party in calling a truly international congress of representatives of aeronautical Scientific organizations for the purpose of investigating the causes of the trouble and finding the remedy.

2nd—The proposed Congress of Aeronautical experts should take up the matter of definitions, symbols and graphical methods used in aeronautical reports, books and other publications which, at the present time, in the absence of any uniform standard accepted and adopted by leading scientists and aeronautical organizations, same as are adopted in statics, dynamics and in the art of applied engineering, (as for instance in the testing of materials) follow the line of thought of some particular group of technical men without any reference to the symbols, the terminology and the graphical methods of representation used by other groups of technical men in other countries. Here again we are confronted with the fact that scientific and technical aeronautical reports and publications have no other excuse for being edited than their usefulness in facilitating the task of aircraft designers and manufacturers, in designing and manufacturing better aircraft.

It is already bad enough that the people of the world do not talk the same language, if we add to this the self imposed handicap of a different scientific language spoken in each country in aeronautical publications, I do not see how we are going to be fully benefitted by the efforts made by scientists and technical men all over the world who are trying to perfect for us a new means of transportation which will have a tremendous influence on the progress of this civilization of ours.

We cannot too strongly insist on the fact that when in reading a report we are stopped either by the meaning of a symbol or by the value of a coefficient it is impossible to follow the sequence of ideas and the report is usually thrown aside.

The proposed Congress can remedy to such a state of things if the matter is approached in a true spirit of international coöperation in the scientific and technical progress of aeronautics, by adopting some fundamental standards which, without any doubt, would be accepted by technical writers all over the world.

How the Discussion on Standardization Started

The suggestion contained in my article of June 20th, 1919 in the AERIAL AGE, gave rise to a very interesting discussion in that review which was contributed by leadng aeronautical authorities and, furthermore, it found an echo in the First International Congress of Aerial Navigation and in an informal congress of leading Scientists and technical men which was recently held at Innsbruck (Tyrol).

Considering the great importance of the subject and the urgent need of arriving at a practical conclusion of the very regrettable state of affairs prevailing at present in the technical and Scientific field of aeronautical work, due to the delay in calling the proposed congress of representatives of leading aeronautical laboratories, scientists and technical men engaged in aeronautical research work in every country, a little history of the case and a resume of the opinions expressed by leading aeronautical authorities on this matter shall be probably helpful.

On May 1919 I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics for the purpose of establishing the promotion of a prompt and cordial exchange of scientific and technical data and information on research and experimental work in aeronautics and sciences thereto allied between the United States on the one hand and the Governments, private institutions and individuals in Europe on the other hand.

In October 1919, in a report to the National Advisory Committee for Aeronautics prepared by W. Margoulis, former director of the Eiffel Aeronautical Laboratory, and at that time my assistant in Paris and Aerodynamical expert of the Paris office of the Committee, the need for the inauguration of a cordial spirit of coöperation between the various leading scientists and organzations doing research work in aeronautics both in Europe and in the United States was pointed out, and the suggestion was made that the Committee should take the initiative in organizing a congress of representatives of aeronautical laboratories to be held in Paris for the purpose of arriving at a mutually satisfactory agreement on the means to be devised for obtaining:—

1st—More reliable results in wind tunnel experimental work, based on a better knowledge of existing conditions in each wind tunnel,

2nd—the adoption of uniform fundamental symbols and definitions in aeronautical reports and publications,

3rd—the adoption of standard graphical methods of representation of ordinary test results so as to facilitate the comparison of results obtained in various countries,

4th—the adoption of a standard method of classification and indexing of aeronautical publications so as to facilitate research work.

The National Advisory Committee for Aeronautics approved all of the above suggestions with the exception however that, considering the fact that the British Advisory Committee for Aeronautics had contributed during the war a good deal more than the corresponding American Committee to the advancement of aeronautics, it was deemed desirable that the initiative in originating a move such as I had suggested would be taken by the British rather than by ourselves.

Accordingly I took up the matter with the British Advisory Committee for Aeronautics and communicated to them the views of the N.A.C.A. on this matter.

In 1920 an invitation was issued by the British Advisory Committee for Aeronautics to our own Committee and to the leading aeronautical laboratories in France, Holland and Italy to conduct a number of comparative tests in their various wind tunnels on the same model—No invitation was issued to German and Austrian Laboratories to participate in these tests, and no provision was made for agreeing on the unification of symbols, definitions, graphical methods, etc.

In June 1921 I resigned my position as Technical Assistant in Europe to the National Advisory Committee for Aeronautics and I published in the AERIAL AGE under the title "Standardization and Aerodynamics" the suggestions contained in my earlier report to that committee regarding the organization of a Congress of representatives of aeronautical Laboratories both in Europe and in the United States. Since that time the following comments have been expressed in the technical press and elsewhere on this subject:—

German Comments

Prof. L. Prandtl, Director of the Aerodynamical Laboratory of the University of Göttingen, Germany and one of the foremost German scientists who has greatly contributed to the present stage of development of Aerodynamics, approves of the idea of calling the proposed congress, which however, he suggests, should be preceded by an exchange of views by correspondence between those participating to the Congress, so as to prepare the ground for a quick settlement of the various points involved. He offers a number of valuable suggestions as to the way comparative tests should be made in the various wind tunnels in order to bring about a better agreement between testing results obtained in various countries.

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Dr. Ing. W. Hoff, Director of the Deutsche Versuchsanstalt für Luftfahrt at Adlershof, Germany, in a letter addressed to me endorsed Prof. Prandtl's comments and suggestions.

Prof. Von Karman, Director of the Aerodynamical laboratory of Aachen, Germany, points out the important need of reaching an agreement on the matter of standardization of symbols, coefficients and methods of measurement of air speed in wind tunnels. He points out the many objectionable features of the present state of things which is fraught with danger to the science of Aerodynamics—he thinks that an international aeronautical association organized along the same lines as the International Society for Testing Materials would provide a very good permanent medium of exchange of views between Scientists of all nations in the interest of Standardization—he approves of the idea of calling a congress of representatives of aeronautical laboratories which he suggests should be instrumental in laying the foundation of a permanent International Scientific Aeronautical Association. (Aerial Age, January 2, 1922)

Italian Comments

Col. Ing. G. Costanzi former Director of the Royal Aircraft Establishment in Rome, Italy, who during and after the war was the representative of the Italian Air Service to the Supreme War Council in Versailles, and the technical representative of Italy to the permanent Interallied Aeronautical Commission in Paris approves unreservedly the calling of the Congress and the suggested matter to lay before the Congress for discussion. He emphasizes the necessity of putting a stop to the prevailing lack of agreement between experimental results obtained in various laboratories. He also states that it would be unconceivable to reach any agreement in this matter without inviting the representatives of German Aeronautical Laboratories to the proposed Congress which, in his estimation, should be held in Germany, where aeronautical works of the highest order of both scientific and practical importance have been originated in the last few years. (Aerial Age, February 20, 1922)

Lieut. Col. Ing. R. Verduzio, Director of the Aeronautical Experimental Institute in Rome, Italy, considers the suggestion as a timely one, approves the program laid out for the Congress and states that Italian Aeronautical Services shall be very glad to coöperate to its realization. (Aerial Age, April 3, 1922)

Lieut. Col. A. Guidoni, Aeronautical Attache to the Italian Embassy in Washington and a well known authority in aeronautics, suggests in a letter to the writer that the matter of the adoption of the metric system in aeronautical measurements should be taken up by the Congress in connection with the matter of Standardization of Symbols. He points out that the Interallied Aeronautical Committee had already started a very important work of Standardization which could be taken as a basis for further expansion by the proposed Congress.

French Comments

W. Margoulis, former Director of Eiffel Laboratory, Paris, France discussing the tests suggested by the British Advisory Committee for Aeronautics, points out that comparative tests in wind tunnels, in order to serve the purpose for which he originally suggested them, must be both numerous and systematic in order that, as a whole, they may characterize the airflow in each wind tunnel. The tests suggested by the British Advisory Committee for Aeronautics are to be made on a model of Streamline body supplied by the National Physical Laboratory and successively tested in the various laboratories in England, France, Holland, Italy, and the United States. Mr. Margoulis points out that in October 1920 in a paper read by him at one of the monthly meetings organized in Paris by himself and the writer for the discussion of Aeronautical problems (and which was published in the "Technical Review of Aeronautical Works" issued by the Paris office of the National Advisory Committee for Aeronautics) he suggested that comparative tests in wind tunnels, in order to be effective, must include tests on spheres, cylinders and streamline bodies of different dimensions and aspect ratio, tested at all available speeds in each wind tunnel and also in the open air on the aerodynamical truck of the St. Cyr Institute, so as to supply a much needed knowledge of free flight tests of models as compared to wind tunnel tests of the same models. (Aerial Age, March 6, 1922)

Austrian Comments

Dr. Ing. Richard Katzmayr, and Prof. Ing. Richard Knoller, of the Aerodynamical Laboratory of the Technischen Hochschule of Wien, Austria both agree on the urgent need of calling an International Congress of representatives of Aeronautical Laboratories and suggest preliminary comparative tests in wind tunnels of various countries on standard bodies such as Spheres, Streamline bodies and one or two airfoils, the same models to be successively tested in the various wind tunnels. These preliminary tests to be made for the purpose of determining what the writers call a "laboratory factor" or a constant expressing of all those elements which are peculiar to each wind tunnel and which cannot be deduced mathematically, such as: turbulence of the air stream, ratio between dimensions of model and dimensions of working section of wind tunnel and, especially, the influence of the method of fastening the model to the balance.

Prof. Knoller and Dr. Katzmayr also state that one of the most important tasks of the proposed congress should be the standardization of symbols and definitions used in aerodynamics and make suggestions along this line. Prof. Knoller as early as the year 1914 suggested the adoption of absolute units in fundamental formulas used in aerodynamics—as to the unification of methods of graphical representation it is pointed out that both in Germany and Austria the same methods are used. (Aerial Age, May 8, 1922)

Dutch Comments

Dr. E. B. Wolff, Director, Dr. C. Koning and Dr. A. G. Baumbauer in charge of the aerodynamical tests at the Aerodynamical Institute of Amsterdam (Rijka-Studienst voor Luchtvaart), entirely agree on the necessity of calling the proposed congress and unreservedly approve of the suggested program of activities of such congress. On the matter of comparative wind tunnel tests, they agree on the preliminary limited program suggested by myself but they suggest an additional number of Systematic tests to be undertaken by only a few of the most up-to-date laboratories in order to separate the causes of errors in wind tunnel experimental work as due to: the method of measuring forces, the influence of the boundaries of the air stream and the nature of the air stream itself. This last cause of error, which includes: irregularities of the air velocity at different points of the cross section of the wind tunnel in regard to time, turbulence of every kind and variation of static pressure, however, should be investigated quite thoroughly in every wind tunnel. (Aerial Age, June 1922)

American Comments

Dr. A. F. Zahm of the Aerodynamical Laboratory, Bureau of Construction and Repair, U. S. Navy, believes that the inclusion of a very great number of laboratories in the comparative tests is not advisable at the beginning, but he is certainly in favor of making these tests in the most important aerodynamical laboratories and he points out that in order to bring about the desired results, the experimental program adopted should be at least as comprehensive as the one suggested by Dr. E. B. Wolff in the Aerial Age of June 19, 1922 and should be followed up in accordance with a common plan of attack and with a common formulated theory to furnish guidance and precaution. In two papers published by the National Advisory Committee for Aeronautics (Note No. 23 and Report No. 139) Dr. Zahm had emphasized this feature when the committee was working on its program of comparative wind tunnel tests which we will mention later on. He also believes that the most direct way to study accurately and convincingly the correction to be made for Reynolds numbers in applying model data to aircraft, would be to insert the full scale craft in a wind tunnel of suitable size and he suggests the building of a wind tunnel 10 meters diam. x 20 meters long at the throat providing a wind stream of 10 to 30 meters per second and requiring about 5000 horse-power. In his opinion, such a wind tunnel would be more useful to aeronautics than anything else at the present time. (Aerial Age, September 1922).

In connection with Dr. Zahm's remarks on the usefulness of a large wind tunnel allowing aerodynamical tests on full size aircraft I might mention here that a complete project of a wind tunnel of the same dimensions and requiring the same power as the one mentioned by Dr. Zahm was prepared by Mr. W. Margoulis for the Belgian Government and was transmitted by myself to the National Advisory Committee for Aeronautics in 1920, strongly recommending that it should be taken under consideration. Also, in 1920, a project of a compression wind tunnel (this project also by Mr. Margoulis) was submitted to the Committee by my office in Paris and eventually the tunnel has now been built at Langley Field and shall probably prove to be a very useful testing device, without however detracting any from the very practical (although rather costly) usefulness of a large wind tunnel allowing making tests on full scale aircraft.

The National Advisory Committee for Aeronautics, replying to a letter of mine of last May requesting a statement of the present views of the Committee on the matter of the Congress of representatives of Aeronautical Laboratories which I suggested to them in 1919, makes the following statements:—

(1) "The standard tests mentioned by the British Aeronautical Research Committee are entirely separate from the tests that we have outlined for the wind tunnels of this country. There is however, a connection between the work of our Committee and the Canadian Air Board and it is contemplated that the models for test in wind tunnels prepared by the Aeronautical Research Committee will be forwarded to our committee

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by the Canadian Air Board, after they have been tested in the wind tunnels in Canada. By the same arrangement we will forward the models prepared by this Committee to the Canadian Air Board, and it is contemplated that when the tests of models are made in all the wind tunnels in this country, the models will be sent to Europe after tests have been conducted in Canada.

(2) The aerodynamic Laboratories of Germany and Austria were not excluded from the general list where it is proposed to have the models tested outside of the United States.

(3) The Committee is very sympathetic in regard to reaching an understanding with all countries for the standardization of symbols and methods of graphical representation used in aerodynamics.

(4) The Committee is not willing to take the initiative in the forming of an International Congress for the Standardization of aerodynamics. *Such a congress must of necessity be international in scope and it would be impossible for the Committee to have an official representative there, as the United States Congress does not look with favor upon the United States being officially represented at any international conference.* We would, however have a representative present who will probably join in the discussion but would not have the official standing necessary to vote."

British Comments

The British Aeronautical Research Committee answering a letter of mine requesting a statement of their point of view in the matter of the proposed Congress writes to me:—

"Your letter of March 28th was brought to the attention of the Research Committee at their meeting of April 11th, 1922. They were interested to learn of the steps that had been taken to provide a preliminary exchange of views between a number of experts who had communicated articles in the "Aerial Age" but they do not consider that the time is yet come for the proposed congress of representatives of aeronautical research laboratories. Perhaps the best step that could be taken to coordinate the work of these different laboratories has already been projected, since the international trials on certain models have commenced and the models are en route to the various laboratories approached by the British Aeronautical Research Committee. It seems doubtful whether any additional advantage can be obtained in calling together, at a great expense, a congress of the proposed nature, since at present there is only a relatively small quantity of research work on aerodynamics being carried out throughout the world, and the best means of coördinating work already published arises with the collection of results of tests by the various laboratories on the same models and this is in hand.

We are not at present aware of what steps have been taken to coördinate the standardization of aeronautical terms and symbols. Some years ago, the Royal Aeronautical Society prepared a glossary of aeronautical terms, and later the American Authorities prepared a similar glossary. These agree in most respects. Since that date, the French Authorities have translated the English glossary and are, we understand, in touch with the British Engineering Standards Association with reference to the new revision of the old glossary, which is being prepared by this Association in coöperation with the Royal Aeronautical Society, the Air Ministry, The Aeronautical Research Committee and other technical aeronautical bodies in this country."

Comments Made at the First International Congress of Aerial Navigation

At the First International Congress of Aerial Navigation held in Paris in November 1921 the matter of international coöperation in systematizing wind tunnel work leading to the adoption of uniform fundamental symbols and definitions was the object of a lively discussion contributed by representatives of French, Italian, Dutch, Spanish and other European aeronautical laboratories. American and British laboratories were conspicuously absent at this First International Congress of Aerial Navigation and German Laboratories were not allowed to join.

Mr. Herrera, Director of the Aerodynamic Laboratory of Madrid, Spain, at one of the meetings of The Technical Committee of the First International Congress of Aerial Navigation suggested the organization of an "International Union of Aerodynamic Laboratories" headed by one laboratory (he suggested the Eiffel Laboratory) which should formulate a program of comparative tests on a number of models. According to Mr. Herrera, the same set of models should be successively tested in the various laboratories, following the particular method of experimentation of the laboratory making the tests. After the tests have been completed in all laboratories, the results should be compared and, from the results of such a comparison, enough data should be available as to allow of the adoption of uniform coefficient and the standardization of methods of future experimental work in wind tunnels. (Frankly we fail to see that the matter is so simple as Mr. Herrera seems to think). Mr. Herrera also suggested that this work should be planned for by the one laboratory representing the proposed International Union of Aerodynamic Laboratories and be carried through by the various Laboratories under the supervision of this superdirecting laboratory (the Eiffel Laboratory).

Prof. Soreau, Vice President of the Aero Club of France and Chairman of the Technical Committee of the First International Congress of Aerial Navigation, objects to Mr. Herrera's suggestions for two reasons: 1st—because he does not see that it is possible to establish a supergovernment of aerodynamical laboratories as suggested by Mr. Herrera and, 2nd—because in order to compare the results obtained in two laboratories it is essential that the conditions under which experiments are made be the same, therefore, it seemed to him that the proper thing to do would be to adopt first uniform methods of experimentation (as for instance the same method of attaching the model to the balance) and then make the tests, rather than doing the reverse as Mr. Herrera suggested.

Dr. E. B. Wolff, Director of the Aerodynamical Laboratory of Amsterdam, Holland, referring to his correspondence with the National Advisory Committee for Aeronautics and the British Aeronautical Research Committee regarding the proposed comparative wind tunnel tests, states that after receiving the invitation to participate in the tests suggested by the British Aeronautical Research Committee he has not heard any more about this matter. He suggests that something should be done, without any further delay in order to start the proposed comparative tests on the same models in the various tunnels.

Mr. Louis Breguet, French Aircraft Designer and Manufacturer, endorses the suggestion made by Mr. Herrera and by Dr. Wolff and suggests the appointment of a committee charged to make definite suggestions leading to the standardization of methods of experimentation in wind tunnels and to the standardization symbols used in aeronautical works.

Mr. W. Margoulis, reports to the Congress the initiative taken by himself and by myself in 1919 in order to bring about the proposed comparative tests. He deplores that the British Aeronautical Research Committee has not gone any further in the realization of its test program than issuing an invitation to participate in some comparative tests on a model prepared by that committee, which, however, has never been sent to the various laboratories to which the invitation was issued.

Prof. Soreau, chairman, answering Mr. Margoulis's remarks regarding our unsuccessful efforts in 1919 to try to induce the National Advisory Committee for Aeronautics to take the initiative in bringing about a much desirable co-operation between aerodynamical Laboratories, states that he knows the reasons why both Mr. Margoulis and myself failed three years ago. He could not reveal what the reasons were but he could state nevertheless that the stumbling block was represented by some governments (meaning the United States, quite evidently) who are not inclined to take part in international conferences. Such being the case, he said, it would seem that the appointment by the First International Congress of Aerial Navigation of a committee such as it had been suggested by Mr. Breguet would not constitute the most advisable step to take at the present time, especially considering the fact that most of the aerodynamic laboratories in every country are under government control. In his opinion, the best thing to do would be to adopt a number of resolutions and submit them to the French Under-Secretary of State for Aeronautics which would take up the matter of Standardization of Symbols notations and methods of experimentation with foreign governments.

Mr. Breguet and Mr. Prix of the St. Cyr Aerodynamic Institute insist on the appointment of a committee.

Col. Verduzzio, Director of the Aerodynamical Laboratory of Rome, Italy, points out the great disadvantage under which the work in aerodynamics is proceeding at present in the absence of an understanding between aerodynamic laboratories on the matter of experimental methods adopted and in the absence of uniform symbols and notations having the same meaning in every country. The latter, according to Col. Verduzzio is of the greatest importance and he submits to the Congress a list of symbols and notations prepared by the Italian Aeronautical Technical Services which, he suggests, could be taken as a basis in the discussion for the adoption of international standards. Col. Verduzzio refers to the failure of the British Aeronautical Research Committee to carry through the proposed program of international wind tunnel tests on a model supplied by them and, in order to get started, he suggests that each Laboratory should make its own model from the same drawing and start the tests.

Col. Fortant, Director of the French Technical Section of Aviation, suggests that, independently of any governmental action by the Under-Secretary of State for Aeronautics in

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dealings with foreign governments in the matter under discussion, as suggested by Prof. Soreau, the suggestion made by Mr. Breguet and others regarding the appointment of a committee be at least unofficially adopted and that the representative of aerodynamic laboratories attending the Congress meet together and exchange their views on the matter of symbols and comparative tests which, in their opinion, should be the object of an international agreement.

Resolutions Adopted by the International Congress of Aerial Navigation

At the close of the First International Congress of Aerial Navigation the following resolutions were adopted expressing the views of the Technical Committee which were offered by the Congress with the suggestion that they should be adopted by Governmental and civilian aeronautical organizations:

"Resolution No. 3—To make a study of the measures which may be immediately adopted in the test methods of aerodynamical laboratories in order to make it possible to compare results; in particular to define the geometrical forms and the material realization of a large number of typical models, which tested systematically in well defined conditions, would serve, in some sort, as a characterization of a wind tunnel; also to bring about an agreement that the same collection of such models be tested successively in the various laboratories.

"Resolution No. 4—Unification of terms and notations employed in the aeronautical publications of the different countries."

The appointment of a committee charged with the actual carrying through of the work outlined in resolutions No. 3 and 4 which had been advocated by Mr. Breguet and others did not take place and, besides expressing a more or less sentimental wish that somebody, somewhere, would do something in the direction pointed out in the two resolutions quoted above, the First International Congress of Aerial Navigation did not do a thing for bringing about the much desired international wind tunnel tests and the standardization of symbols, terms and graphical methods employed in aeronautical publications of the different countries represented at the Congress, in spite of the fact that urgency of such a measure had been pleaded for by the representative of every aeronautical laboratory attending the congress.

It is no wonder, however, that the first International Congress of Aerial Navigation could not accomplish anything in a matter such as this which required the cordial co-operation of scientists of every nation, when we stop to consider that American and British scientists were conspicuously absent and German, Austrian and other scientists of former enemy nations were not allowed to join this congress which was held under the auspices of the French Government.

The Moral of a Sad Story

From the above history of the fruitless efforts which have been made during the last three years by scientists and technical men of all countries interested in aeronautics in order to bring about a much needed international co-operation in aeronautical research work in the interest of aeronautics as a science and as a new and tremeudously important branch of engineering, we can draw the following conclusions:

(1st) It is well recognized by all leading authorities in aeronautical research work that the lack of co-operation between the various aerodynamic laboratories in adopting a common standard whereby the results of wind tunnel tests can be intelligently interpreted and compared to each other (wherever it stands to reason that such a comparison should be possible) is fraught with danger and tends to destroy the confidence of aircraft designers and manufacturers in wind tunnel tests which are now the only scientific guidance that aerodynamics can give to the aircraft designing engineer in order to allow better and safer design of aircraft.

(2nd) The present chaotic condition existing in the matter of symbols, definitions and methods of graphical representations used in aeronautical technical reports and publications edited in various countries, makes it almost impossible for anybody who is not familiar with the technical aeronautical terminology adopted by each country to derive any benefit from publications and reports edited in any other country than his own.

(3rd) The present lack of co-operation between aerodynamic laboratories and the handicap brought about by the absence of a uniform scientific aeronautical language having the same meaning in every country, is not due to a lack of appreciation by scientists and technical men engaged in aeronautical research work of the very undesirability of the prevailing situation. On the contrary, almost all of them are ready to enter into and to abide by any sort of international agreement which will correct the present state of affairs.

(4th) Due to the fact that all leading aeronautical laboratories and other aeronautical scientific organizations in the world are under government control, any initiative in the desired direction can only be taken at the present time by one, or more, governmental aeronautical institutions with the approval and the active support of the government machinery back of it.

(5th) Any move of this sort originated by the aeronautical services of any of the big nations in Europe is bound to be influenced by political considerations, by limitations imposed by the treaty of Versailles, and by resolutions officially adopted during the war at interallied meetings of prominent scientists and representatives of academic bodies on the matter of post-war co-operation with scientists of, at that time, enemy countries.

(6th) Quite evidently under these conditions it is impossible to reach a truly international agreement, such as it is desired, as long as German aeronautical progress and German scientists are either ignored or snubbed.

The failure of the First International Congress of Aerial Navigation to work out any plan for meeting the situation, which had been brought to their attention by those most interested in and most concerned with the desirability of reaching an agreement on the matter of international co-operation in aeronautical research work and on the matter of standardization of aeronautical technical terminology, provides the best illustration of the futility of placing any hopes in the outcome of the vague recommendations presented by its technical committee to the French Under-Secretary of State for Aeronautics.

(7th) The program of wind tunnel tests on a single model successively tested in various wind tunnels in Europe and in America which was outlined by the British Aeronautical Research Council almost three years ago (and which, as far as I know, has not materialized as yet) did not include and does not include at the present time, for all I know of, the co-operation of German Aeronautical laboratories. Furthermore that program was not prepared with the collaboration of any of the laboratories invited to join in the proposed tests; it was simply a British ready-made program of wind tunnel investigation work which discussion in the Aerial Age of this subject has failed to prove that it was the most acceptable one to all concerned. On the contrary that discussion has lead to the contribution of a good many suggestions by prominent aeronautical authorities which most certainly should be taken into consideration before formulating a program of international coöperation in a work which is to be purposely undertaken in the interest of the scientific and technical progress of aeronautics in all countries.

Our National Advisory Committee for Aeronautics an Important Factor in International Aeronautics

When three years ago I suggested to and strongly urged upon our National Advisory Committee for Aeronautics to take the initiative in calling a meeting in Paris of the representatives of leading aeronautical laboratories in the United States and in Europe for the purpose of outlining a program of international wind tunnel tests which would have eliminated the present objections to wind tunnel experimental work, and which would have laid out the basis for the adoption of a much needed consistent uniformity in aeronautical technical terminology, I was prompted by the fact that I knew that our National Advisory Committee for Aeronautics was the only aeronautic scientific organization in the world which could have undertaken this task and carried it through to a successful conclusion.

In fact, this Committee had the assurance of the most effective co-operation of scientists of all nations (former allied and former enemy nations) who, in spite of the official taboo which separated and still separates in most European countries scientists in two groups: *friendly* and *enemy*, would have welcomed any attempt on our part to bridge the gap, insofar at least as aeronautics are concerned.

Furthermore, our National Advisory Committee for Aeronautics being as it is directly responsible to the President of the United States and to Congress only, is the only aeronautical scientific organization in the world under Government control which is independent of all governmental departments, while at the same time it co-operates with all of them as well as with our national aircraft manufacturing industry, with engineering societies, universities and other educational and academic bodies engaged in aeronautical research work in this country.

The contribution made by this Committee to the advance of research work in aeronautics during the last five years, with the insufficient funds placed at its disposal by Congress, places our National Advisory Committee for Aeronautics in a position of natural leadership in the scientific field of aeronautics, and furthermore, the disinclination on the part of the American people to discriminate between scientists of former enemy and former friendly and neutral nations would have created an atmosphere of confidence and a spirit of

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effective co-operation in a meeting of representatives of aeronautical research laboratories organized by this Committee. This, however, could not be accomplished due to the fact that the National Advisory Committee for Aeronautics must look upon Congress for guidance on all matter more or less directly related to our dealings with foreign nations. As it is stated before, the Committee (1) is very sympathetic in regard to reaching an understanding with all countries for the Standardization of symbols and methods of graphical representation used in aerodynamics (2) it is more than sympathetic in regard to wind tunnel tests leading to a definite and practical utilization in the future of wind tunnel work and (3) it is not disposed to ignore the existence of German and Austrian Aeronautic laboratories and scientists. On the contrary this Committee has been the first one which has adopted for wings the same co-efficients used by the Göttingen Laboratory simply because they were the most logical coefficients to adopt. (This example, I understand, is going to be followed by French laboratories. As far as British laboratories are concerned, it is very doubtful indeed if they will ever adopt symbols coefficients and graphical methods of representation others than their own).

The Views of Congress on International Coöperation

The stumbling block on the road of progress and international coöperation at least in the scientific field of aeronautics) which could have been brought about by the only governmental aeronautical research organization in the world capable of obtaining the desired results, is represented by the unfavorable standpoint from which our present Congress is inclined to look upon any international conferences between ourselves and European powers. Under the circumstances, it is quite natural that the National Advisory Committee for Aeronautics should not be willing to take the initiative in the organization of an International Congress for the Standardization of Aerodynamics. As a matter of fact, should such a congress be organized by another nation, our National Advisory Committee for Aeronautics could not even be officially represented there, same as it has not been represented at the First International Congress of Aerial Navigation or at any other of the international aeronautical conventions which have taken place in Europe during the last three years, where most important decisions affecting international aerial navigation have been taken in our absence, without any reference whatsoever to our present or future interests in that direction.

It is not this the proper place for discussing either the wisdom of the narrow mindedness of our policy of isolation (neither splendid nor always consistent with our national interests) which we are pursuing under the present Congress in every event taking place, sometimes three and sometimes twelve miles off our shores, but this is certainly the place where we can say that the unwillingness of Congress either expressed to, or assumed by, the National Advisory Committee for Aeronautics, to allow that body, who has done and is doing some splendid work, to establish closer ties between American and European aeronautical scientific research institutions, is neither consistent with the progress of aeronautics nor with dignity of an organization which should be left free to work in the interest of science unhampered by political considerations.

When three and a half years ago I suggested the establishment of an office in Europe of the National Advisory Committee for Aeronautics for the purpose of establishing and maintaining a cordial exchange of thoughts between American and European Scientists working on Aeronautics and Sciences thereto allied, and when my suggestions were approved by that Committee and I was appointed its representative in Europe for the purpose of carrying through that program, the keynote of our National policy was: co-operation with Europe. We went too far, however, or probably our motives and our lofty ideals which prompted our desire to co-operate with Europe in the re-establishment of order and peace in the world were not met with in the same spirit such as we were actuated by. At any rate, with the advent of the new administration, a complete reversal of our foreign policy took place and, helas, I soon discovered that the fine spirit of international scientific co-operation in Aeronautics, which had provided the only reason for establishing a foreign office in Europe of the National Advisory Committee for Aeronautics, had been damped to such an extent that my activities in promoting co-operation were actually embarrassing the Committee. After two years of persistent efforts I had to withdraw from a work which, however, I feel has sown good seed which shall bear fruits later on when it will be more fully realized. both in this country and in Europe, that the root of all our evils in the difficult period of evolution of the human race that we are going through is the lack of co-operation between the intellectuals of all nations.

The Discussion Has Served its Purpose

The efforts made by Mr. Margoulis and myself during the last three years for promoting a congress of representatives of aeronautical research laboratories and other scientists working in aeronautics in the interest of the scientific progress of Aeronautics have not been lost, and the discussion in the Aerial Age of the subject "Standardization and Aerodynamics," I feel, has served its purpose which was to show that intellectual co-operation in aeronautics can be achieved and must be achieved by taking into consideration the views of all before trying to place our own interpretation on what should be done in the pursuance of a plan calling for the co-operation of others.

The suggestions that we made three years ago on the subject of wind tunnel tests have been adopted in principle by all aerodynamic laboratories, however, both the British Aeronautical Research Council and our National Advisory Committee for Aeronautics have each formulated a test program of their own without taking under consideration the views of other laboratories and each proposes to go ahead with its own program and make its own models, test them according to its own ideas and then ask other laboratories to duplicate the same tests on the same models.

Other laboratories, I understand, are planning to do the same thing and the consequence of this lack of co-operation between the various laboratories in formulating a unique program of experimentation agreeable to all shall bring about a useless loss of time and energies. Since the necessity of making these comparative tests has been recognized by all concerned why not try to make them as complete as possible in a true spirit of international scientific co-operation?

The discussion of this subject, both in the Aerial Age and at the First International Congress of Aerial Navigation, has supplied enough elements to approach the problem of Standardization and Aerodynamics on some sort of well defined basis. It should not be difficult to co-ordinate the various suggestions made by the directors of the various laboratories and to find a common ground on which an agreement might be reached. This can be accomplished mostly by correspondence. After an agreement has thus been reached on general lines, a meeting of American and European representatives of aerodynamic laboratories and leading scientists engaged in Aeronautical research work could be easily arranged for. A meeting of this sort bringing together scientists of all nations, which on account of the war find themselves separated by nationalistic barriers, would make it possible to work out the details for carrying through a program of immediate and future actions and, furthermore, would supply the human factor as represented by the personal contact of men having the same object in mind: the progress of science.

Let Us Have Peace

In spite of the war, in spite of the tremendous turmoil of hate, lust and avarice, in spite of the re-awakening of all the baser instincts of the human race which the war has unchained, we can see the signs of a new era dawning upon us. Social reforms based on the old standards of personal and nationalistic advantages shall never restore peace and order, unless we realize first the true meaning of the law of brotherhood and stand ready to compromise on the matter of personal rights, privileges and advantages in the interest of all.

The intellectuals of the world, scientists and technical men engaged in the work of developing and perfecting new inventions are the pioneers of this new era. It is up to them to realize the meaning of the divine love, of which science is the noblest expression, and it is up to them to give the example and to teach the objective lesson that the world needs: The unselfish co-operation of all in the realization of a common good.

Aeronautics and the enormous possibilities offered by aeronautics, which represent the outstanding engineering progress born out of the war, points out the way to us where international co-operation of scientists and technical men starts.

We have in aeronautics a new science, a new branch of engineering, a new and fundamentally international means of communication. The men who are working in aeronautics are new men, they understand the need of co-operation, they are ready to co-operate with each other, they invite the leadership of a group of progressive scientists of a progressive nation to bring about the formation of a nucleus of the great brotherhood of the intellectuals of the world.

Can I be blamed for continuing, after three years of efforts (not fruitless by any means) to look upon our National Advisory Committee for Aeronautics as the best adapted Aeronautical organization in the world for bringing about the desired results? Especially so when we consider that the Committee is in sympathy with the idea of an international congress of scientists working in aeronautics and would be ready to join in a discussion leading to a better understanding

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of wind tunnel work and to the Standardization of Symbols, notations and methods of graphical representation used in technical aeronautical works, if it was not prevented from doing so by the stand taken by Congress on the matter of American participation to International conferences.

Only last September a pathetic appeal was sent by German and Italian Scientists working in aeronautics to scientists of other nations to take part in a meeting held at Innsbruck (Tyrol)—The invitation read: "The research work of the last years has brought about in all countries considerable progress in the development of the classical theories as well as of the fundamental problems of practical hydraulics and aerodynamics. On account of political events the interchange of ideas and personal intercourse among Scientists have been impaired. By the said meeting we intend to avoid whatever hinders at the present time the success of official international Congresses. We simply want to rally without any formalities the scientists interested in these special problems."

American, British and French Scientists did not answer the call of their German and Italian brethren, not because they did not want to, but because they could not on account of the unfortunate preponderance of political consideration over other considerations of higher nature. This seems to be the price that scientific research work in aeronautics must pay nowadays in order to obtain the scanty credits granted by the various governments for that purpose.

It is rather amusing to see that, of all governments subsiding scientific research work in aeronautics, the German government should be the first one who has not opposed its veto to the action taken by Prof. Prandtl and by Prof. Karman in calling this first international congress of scientists working in aeronautics.

An Appeal to the National Advisory Committee for Aeronautics

I wish to close the present discussion of the subject "Standardization and Aerodynamics" by appealing once more to the members of our National Advisory Committee for Aeronautics urging them to use their personal influence and the enormous prestige of the finest aeronautical Scientific organization in the world, for obtaining from Congress the recognition of the fact that a wider range of independence from political considerations by that Committee in the field of international co-operation in the interest of the scientific progress of aeronautics is worthy of the high standards of that institution and is consistent with our national interests.

The first step along the road of collaboration with Europe in the work of reconstruction (which, no matter if we like it or not, we shall have to travel sooner or later) it is just and right that it should be made by American Scientists. Such a step would be entirely consistent with the desire repeatedly expressed by the nation, the President and by members of its Cabinet, to co-operate with European Nations in any constructive plan leading to the re-establishment of peace in the world.

Who can suggest of any better plan leading to the re-establishment of peace in the world than the one brought about by promoting an increased collaboration between Scientists and technical men all over the world? And if the initial move in that direction can be made by promoting peace and collaboration between scientists working in aeronautics who are ready and eager to fulfill the law of international brotherhood, why not let aeronautics lead the world along the path of intellectual evolution on which, in spite of all adverse, forces we are steadily progressing?

Why short sighted and short lived political considerations should deprive this nation and our National Advisory Committee for Aeronautics of the great privilege of being able to make the first move?

Quoting President Harding's Words

The words spoken by the President at the Commemoration of the fourth anniversary of the Armistice truly represent the sentiment of the great majority of the American people on the matter of co-operation with Europe:—

"I think we have come to realize, as a nation, that we cannot hope to avoid obligations and responsibilities, often arduous and burdensome, as part of the price we must pay for our fortunate relationship to the confraternity of the nations. It will be greatly to the national benefit, I am sure, if those who most intimately participated in the events of the great world, and among them I, of course, include particularly the men of the overseas forces, shall always keep in mind the fact that their noble service to their country and civilization has imposed upon us a duty to recognize that henceforward we must maintain a helpful and sustaining attitude in all the broader relationships that involve the nations. Our first duty will, indeed, be to our own, but that duty cannot be adequately discharged in narrowness and selfishness.

"That we may be guided to a just judgment of the time and occasion for further proof of our interest in the common cause of humanity, and in choosing the methods whereby to discharge the obligation thus created, will be, I am sure, a fitting prayer for this armistice anniversary."

Let us keep in mind that we can help making this world safe for democracy in one way only: by taking our share of obligations and responsibilities in building up a new International: THE INTERNATIONAL OF BRAINS AND HEARTS.

TABLE IV

Evaluation of Thrust and Torque for Secondary Conditions :

Station	2	3	4	5	6
Radius	2.00	2.67	3.33	4.00	4.67
2 — r n	314	420	523	628	735
tan Ø	.3180	.2383	.1910	.1590	.1362
cos Ø	.9530	.9727	.9822	.9876	.9909
Ø	17° 38′	13° 25′	10° 49′	9° 2′	7° 45′
k	.0366	.0366	.0366	.0366	.0366
x°	—72.°	—8.2°	—6.2°	—5.2°	—4.2°
Do — Ø	19.5°	18.4°	14.8°	12.3°	10.3°
O	5.6°	4.6°	3.6°	2.6°	1.6° (approx.)
x	6.7°	5.6°	5.0°	4.5°	4.5°
CL	.495	.500	.420	.360	.330
L/D	12.65	13.65	14.50	16.50	17.00
J	4° 31′	4° 11′	3° 57′	3° 28′	3° 22′
Ø′	23° 14′	18° 00′	14° 25′	11° 38′	9° 21′
tan Ø′	.4293	.3249	.2571	.2059	.1647
sin Ø′	.3945	.3090	.2490	.2016	.1625
Ø′ + *J*	27° 45′	22° 11′	18° 22′	15° 6′	12° 43′
tan (Ø′ + *J*)	.5261	.4078	.3320	.2698	.2257
cos (Ø′ + *J*)	.8850	.9260	.9491	.9655	.9755
V (1 + ½a)	126.5	132.0	132.0	128.0	120.0
aV	53.0	64.0	64.0	56.0	40.0
2 — rn b	27.8	26.1	21.2	15.1	9.0
dT/dr	84.5	167	205	210	181
dQ/dr	89	182	227	226	191

TABLE V

Determination of Propeller Characteristics and Evaluation of Useful Power

J	Tc	Qc	K (*M*)	n	V	Pm	Pu
.30	.0827	.00965	45.0	1480	50.5	347	160
.40	.0750	.00827	58.0	1510	68.5	350	202
.50	.0645	.00765	67.0	1570	89.9	371	248
.60	.0517	.00673	74.7	1670	114.0	389	291
.65	.0445	.00613	75.2	1755	129.8	418	314
.70	.0367	.00545	75.1	....	.....	...	...
.80	.0193	.00370	66.5	....	.....	...	...

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General Rules For Air Combat

A Post-war Paper on Pursuit Aviation by an Expert German Pilot—It Visualizes to the Lay Reader What Pursuit Aviation Means to the Sohrabs and Rustums of the Air

Surprise and Attack Regardless of Consequences:

The combating power of the one-seater lies in the attack. In an attack, the surprise and a fearless closing with the opponent as near as possible (less than 100 meters) before the opening of fire, play the chief part. The one-seater makes his surprise attacks, flying out of the sun, toward the enemy, or in the steepest dives.

Proper Shooting Distance

The one-seater is only at the proper shooting distance when he flies into the enemy's propeller whirlwind and constantly has the feeling that he will ram the opponent at once. At such distances the large and close target must be hit by using the gauger and sights even with aiming errors; with the employment of light tracer ammunition the position of the stream of bullets can be frequently improved. The use of the aiming telescope at such short distances is not advisable. Firing at longer distances with the aiming telescope is solely to be used to shoot at a fleeing opponent—to force him, through short bursts at greater distances, to circle and to then cut him off while circling—or to help in time a far-away harassed comrade.

Attacking Direction.

The most effective attacking direction against one-seaters is the one from above to the rear, to the rear and from the rear below. Shooting the opponent from the front is in most cases not possible with the short shot possibility due to the speed of the aeroplanes and the blanketing of the pilot by the engine. An opponent, who shoots while swooping down from a great distance, betrays the beginner or shows shyness to engage in the curve combat at a close distance. Even accidental shots are herewith rare.

Working Together.

Fundamentally two one-seaters should always co-operate even in squadron formation. If one of the two attacks a hostile one-seater, his comrade does not take part in the air combat, but remains in readiness for immediate action and covers the rear back of the comrade against a surprise attack by other hostile aeroplanes. Only then is participation in the combat proper, if the opponent threatens to win the upperhand. The attacked aeroplane is, if it does not burn or break up, always closely pursued till its impact or landing. Turning away from the opponent on account of inexperience or in consequence of hostile action, even if only for seconds, means for the comrade in the vicinity not only the right, but also the duty to take part at once. Herewith the fundamental rule remains, never to impede the curve combat of a comrade by a desire to open fire.

The Opening of the Combat.

With a prompt recognition of the hostile aeroplane turn at once against it, shoot and then try in curve combat to get in the rear or underneath him (if opponent has a rotating motor turn to the right if possible.)

When in doubt as to whether it is a hostile or friendly aeroplane, turn against it at once, push underneath the suspicious machine at full speed and only, if the cocard is recognized or opponent shoots, to pull high and return the fire. With a surprise attack from the rear, if there is no time to turn around, tip up steeply at once with full gas, once again pull up high and go into the curve or immediately with the most powerful rudderpush take the steepest curve.

Curve Combat.

In curve combat the curve must not be changed or downward steering be given, if the opponent ascends above. Herewith there is still the possibility of shooting the opponent from below, as it is not at all advisable, to go above an aeroplane, which can shoot upwards. The curve combat itself is always led with full gas. If the one-seater perceives, that in spite of his efforts the enemy will come behind him because of greater turning ability of his aeroplane or flying superiority, then quickly overdraw the machine in the curve, whereupon it stands at once on its head, turns 3 to 4 times quick as lightning round its own axis, and catches itself again on its own accord after a sudden fall of 100 meters at the most. The pursuer is in this way always shaken off for some time.

Rear Cover.

The one-seater operating alone over hostile territory is easy to combat, when fearlessly attacked, as he lacks the rear cover on the one hand, and on the other hand must strive again to reach his lines. Therefore, with attacks on captive balloons and in squadron combats beyond the front, constant team work is absolutely necessary. This supplies the necessary defense for the rear attack. Frequent practice is, however, necessary.

Combat of the One-Seater against Hostile Double-Seaters.

Herewith too, the surprise plays the chief part on our side and on the other side of the lines, besides making possible a quick rush across the danger zone of the enemy's movable machine gun. Suddenly push down in the steepest drop without shooting, place oneself at once behind or underneath the enemy and only at the last moment operate both rigid machine guns. A flat straight-ahead flight with an attack on the body of the double-seater is absolutely to be avoided. It is wrong to shoot in an attack at distances of over 100 meters and if the opponent answers the fire, to turn. In this moment the enemy is offered a target which is easily hit and without danger to him.

Combat of the Double-Seater against Hostile One-Seaters.

With early recognition of the opponent give the observer notice, while still at a long distance, by short fire bursts, so that he will not be surprised (thus saving ammunition). If the hostile one-seater attacks, then curve with full gas and bring observer into position to shoot.

In case of doubt, whether it is a hostile or our own aeroplane, curve towards it, press underneath it with full gas and, if the enemy is recognized, bring observer into position to shoot from beneath to above.

With a surprise hostile attack at once curve steeply with most powerful rudder stroke, bring the observer into position to shoot. It is fundamentally wrong, to fly straight ahead or—when with shut off gas—to go straight ahead downwards.

The German reconnoitering aeroplane attacked by hostile one-seaters far beyond the line rids himself best of his bothersome opponents, by flying constantly zigzag, as long as the enemy attacks, thus bringing the observer into position to shoot. If the pursuer is lost out of the line of sight for a moment the German double-seater then at once pushes away under full gas and takes advantage of the high speed of the heavy aeroplane. Generally the pursuer does not succeed in overtaking a second time and approaching in an effective distance (50 to 100 m.). Should the one-seater still follow, shooting at 4 to 500 meters, then do not curve nor return fire, but first, quickly put in new drums, turn, push beneath the pursuer and to bring observer in closest distance to shoot upwards. Fundamentally the most dangerous one-seater is the one which tries to get underneath the tail of the double-seater.

Combat of the Double-Seater against Hostile Double-Seaters.

Here the movable machine gun of the observer brings the decision. The task of the pilot herewith is, to bring his observer as often as possible into position to shoot and to curve in such a way that the opponent is offered no aim. An attack of the double-seater with the rigid machine gun will often stupefy the opponent. On our side of the lines the double-seater has also the duty to attack as well as to take part in the air battle of German one-seaters in the vicinity.

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AERIAL AGE

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Night Flying for the Air Mail

DURING the next few weeks the Air Mail will try out aerodrome lighting equipment from various manufacturers at fields every 25 miles along the course from Chicago to Cheyenne. This, in order to determine the best system for the purpose.

Each field will be equipped with a beacon which will have a visibility of approximately 35 miles. The fields themselves will be lighted by means of floodlights to illuminate the landing Ts and by boundary lights to determine the field limits. All buildings will be floodlighted to give, as near as possible, a day-time perspective and in every instance the lighting arrangement will be such that the lights will not shine in the pilot's eyes.

The Post Office believes that the lighting of the 'plane itself is by far the more important item. One of the Post Office 'planes is being fitted with electric landing lights by the Army Air Service at McCook Field.

Transcontinental Flying

THE army aviators who drove a monoplane from California to Indiana before they were compelled to alight missed their goal of a non-stop flight from ocean to ocean. But in flying two-thirds of the desired distance and the more difficult country without a descent in twenty-eight hours they proved the entire feasibility of the project. The hardy flyers who make the next attempt may reasonably expect to find it free from the handicap of a leaky radiator and burned-out engine.

At least there are the best of assurances that the feat will be accomplished in time and probably in the near future. A generation to whose fathers the pony express and the first locomotive across the plains were marvels of fast transportation can hardly be so surfeited with the exploits of aviation as not to feel a new thrill at the near prospect of flying across the continent in a continuous trip. As it is, the performance of Lieuts. Macready and Kelly is both a record-breaking achievement as a sustained flight for 2,060 miles and a notable example of resourcefulness in overcoming the obstacles of violent storms, mountain cross-winds and mechanical hazards. It is one of the great feats of aviation and comparable as a contribution to the development of long-distance flying with the high-speed records for short distances made at the recent Detroit contests. How far away is the Coast-to-Coast Air Limited, to cover the route, on the basis of the Pulitzer Trophy speed records, in from twelve to fourteen hours? (Editorial in N. Y. World.)

Oxygen and Commercial Flying at High Altitudes

THE question of commercial flyin under federal regulations, as proposed in a bill now before Congress for the creation of a Government "Bureau of Civil Aeronautics" is becoming of more immediate and definite interest to promoters of transportation lines, to engineers, insurance companies, pilots, business houses and to the traveling public on whose patronage success depends.

Economy is, perhaps, the first consideration. This means flight at high altitudes, probably at twenty-five thousand or more feet. How, then, are we to breathe comfortably and can we be kept warm? The attainment of high altitudes and the use of the heat available is now the solved problem of the supercharged engine.

However, some light on the medical aspect of high flying is shed by the research work for the National Advisory Committee for Aeronautics by Franklin L. Hunt on the subject of oxygen instruments, which have been employed thus far in the flying at great altitudes.

It has been shown that at altitudes above 15,000 feet the physical condition of aviators—and of the traveling public—is affected by lack of oxygen, unless artificial means is provided to supply the deficiency.

The physiological symptoms are: headache, which is usually the first noted; palpitation, fatigue, numbness of the limbs, pains in one or both ears, weakening of the attention, diminished sense of stability, which means much to the pilot; vertigo, faintness, and finally, loss of consciousness. It is obvious that the existing altitude records have been made with the assistance of someone or another oxygen apparatus.

It has been definitely determined that flying at altitudes of 20,000 feet or more for extended periods can not be undertaken without serious injury to the central nervous system of the aviator.

These physiological symptoms can be almost entirely avoided by supplying artificial oxygen during flight.

The normal man at full atmospheric pressure breathes approximately 16 times a minute. The volume of each inspiration is about one-half liter, so that 8 liters of air is breathed per minute, of which 1.6 liters is oxygen. This, however, is the minimum required. In the case of the pilot of an aircraft, the aviator is continually in a state of physical activity and, therefore, needs more oxygen. It has been found that 4 liters of oxygen per minute is not an excessive amount to supply, allowing for inevitable losses.

The pressure of the air at sea level is approximately 14.7 pounds per square inch. It decreases at the rate of approximately one-half pound per square inch for every 1000 feet of altitude for the first 10,000 feet and more rapidly thereafter. At 20,000 feet the pressure, and consequently the density, is only one-half that at the surface of the earth. Consequently, the traveler would obtain but one-half the normal supply of oxygen at each inhalation.

For high altitude flights it appears that approximately 150 liters of artificial oxygen must be supplied per person per hour, and under average present conditions a supply for a 2½-hour flight is carried. This oxygen is stored either in bags in the fuselage of the machine compressed in steel cylinders or liquefied. From the containers the oxygen is supplied to the pilot through reducing and regulating valves, a flow indicator and tubing to a mask worn over the face.

With the inauguration of high-altitude, high-speed long-distance airplane lines, one may expect air tight

(Concluded on page 611)

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THE NEWS of THE MONTH

Aerial Photography and the Oil Fields

The airplane has been put to one of its most novel uses in the taking of pictures for a mosaic of the Salt Creek and Teapot oil fields in Wyoming. This unusual photographic feat was performed for the Bureau of Mines by the Air Service of the Army. An area of 336 square miles was photographed. The pictures were taken from an elevation of 15,000 feet above sea level on films 100 feet in length. It required in the neighborhood of 450 pictures and 16 hours flying time to cover the area. Some of the richest oil bearing reserves on the public lands of the United States are included in this area.

A Veteran Pilot

Probably the oldest aviator in the world, Colonel C. C. Dickinson of Chicago, 62 years old and a pilot, recently left Washington en route for Chicago on the last leg of a remarkable flight. The Colonel, in his Laird-Swallow aerial knockabout, flew from Chicago to the recent Aviation Meet at Detroit and, following the Pulitzer Trophy Races, hopped off for a trip to Florida, stopping over one day on the return flight to visit the National Headquarters of the National Aeronautic Association in this City.

Colonel Dickinson, then 50 years of age, was taught to fly in 1910 by the famous British pilot, Claude Grahame-White, who visited this country for the Gordon-Bennett aerial races of that year. Since that time the Colonel has been an aeronautical enthusiast and a supporter of the progress of commerical aviation in this country. He took an important part in the deliberations of the Detroit Aeronautical Congress, and was a much interested observer of the Pulitzer Races.

On reaching Chicago Colonel Dickinson will have completed an aerial tour of 3,510 miles which, for a man of his age, might seem remarkable, but the Colonel considers it nothing unusual in view of the present reliability of American aircraft, and the luxurious comfort of traveling by air.

Amundsen Plans Flight for May

Captain Roald Amundsen plans his flight Wainwright, Alaska, across the north pole next May or June, according to Captain C. S. Cochran of the Coast Guard cutter Bear, which was in Seattle recently after a long voyage into the Arctic Ocean. Captain Amundsen, who left here in the schooner Maud in June, spent much time aboard the Bear in the arctic. Ice in the arctic is the worst since 1906, Captain Cochran reports. Captain Amundsen intends to go to Nome, Alaska, this Winter by dog team, and to return to Wainwright for his flight with Lieutenant Oskar Omdahl, he told Captain Cochran.

Aeronautical Safety Code

In accordance with a request from the Sectional Committee for the American Aeronautical Safety Code, the National Aeronautic Association of U. S. A. has appointed its Vice-President, Bernard H. Mulvihill, and Col. Harold. E. Hartney, its general manager, as members of the Committee.

This Committee today finished its deliberations at the U. S. Bureau of Standards, Washington, D. C., where, for the last two days, together with various Subcommittees, it has been formulating an Aerial Safety Code which shall be a basis for the manufacturers and operators of aircraft in this country to introduce into their activities every measure of safety which engineering practice and operating skill can devise. The whole object of this aeronautical code is to standardize and codify, for the use of such manufacturers and operators, the best possible methods which aeronautical knowledge, at this stage of development, can produce, in exactly the same manner as the manufactures of electrical equipment, automotive engines, and other mechanical industries employ safety codes.

The Sectional Committee is headed by H. M. Crane, M. E., Chairman, formerly of the Wright Aeronautical Company; Dr. J. S. Ames, Head of the Mechanical Engineerng Department. Johns Hopkins University, and Member of the National Advisory Committe for Aeronautics, Vice-Chairman; Dr. M. G. Lloyd, E. E., of the Bureau of Standards, Secretary; and Mr. Arthur Halsted, E. E., of the Bureau of Standards, Assistant Secretary. The representation on the Committee are prominent members of the following organizations:—

National Aeronautic Association of U. S. A., Inc., Manufacturers Aircraft Association, Aero Club of America, U. S. Bureau of Standards, Society of Automotive Engineers, American Society of Safety Engineers, U. S. Post Office Department, National Aircraft Underwriters Association, U. S. Weather Bureau, American Institute of Electrical Engineers, National Safety Council, Underwriters Laboratories, U. S. Coast Guard, Rubber Association of America, American Society of Mechanical Engineers, American Society for Testing Materials, U. S. War Department, and the U. S. Forest Service.

The working out of the safety code has been placed in the hands of special Committees—viz.,

Sub-committee on Airplane Structure.—Dr. E. P. Warner, Supervisor of Aeronautics, Massachusetts Institute of Technology, Chairman.

Sub-committee on Power Plant.—George J. Mead, Wright Aeronautical Corporation, Chairman.

Sub-committee on Equipment and Maintenance of Airplanes.—Archibald Black, New York City Aeronautical Engineer, Chairman.

Sub-committee on Lighter-than-Air Craft (Balloons, Airships, Parachutes.)—Ralph H. Upson, Aeronautical Engineer, Detroit, Michigan, Chairman.

Sub-committee on Airdromes and Traffic Rules (Landing Fields, Airports, Traffic Rules, Signals, Qualifications for Pilots)—Arthur Halsted, Associate Electrical Engineer, Bureau of Standards, Washington, D. C., Chairman.

This Committee has practically completed the codification of safety rules for all of the activities covered by the Subcommittees, which has been a monumental work, but will be undoubtedly the basis for complete co-operation between all agencies engaged in every phase of aeronautics in making air navigation safe, not only from the standpoint of the pilot, but of passengers and public and private property. It has been felt by all these engineering societies that a safety code should grow up with the development of the industry which can be used by aeronautical and operating companies, manufacturing companies, and even by municipalities and states in formulating regulations covering the manufacture and use

John Prest, Vice-President of the First National Bank, San Antonio, who journeyed from New York to San Antonio, Texas in a Sparry Sport Plane.

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of aircraft within their jurisdiction. In this way there will be uniform measures taken, rather than disjointed and conflicting laws, regulations and rules promulgated by forty-eight states, and no one knows how many municipalities.

This activity of the Committee is not an effort to force upon aeronautics discriminatory and retarding rules, but to assist in the development of the science in America in such a way that public confidence in the safety of air navigation will be built up, and that the code itself will be one contributing effort in placing "America First in the Air."

J. V. Martin Patents

Important to those interested in aeroplane efficiency:—The Jas. V. Martin aeroplane patents—

Retractable Chassis June 17th, 1919—May 30th, 1922 and Oct. 3rd, 1922—others pending.

Aeroplane Transmission, Mar. 3rd, 1914 Paul Zimmermann and July 4th, 1922 to J. V. Martin others pending.

Internal contained shock absorber wheel, Oct. 24th, 1922, others pending, etc. Martin Aeroplane Factory, Garden City, N. Y.

Plane to Carry Sportsmen on Hunt in Arctic

Six sportsmen intend to leave this city next summer by flying boat for a hunting trip in the northern Hudson Bay region of Canada. The arduous journey afoot and by canoe through a wilderness swarming with mosquitos will be avoided and they expect to pass not more than seventy-two hours in actual travel, although the time consumed by the journey will be much longer, owing to stopovers.

The men who will make the trip are I. M. Uppercu, president of the Detroit Motor Car Company of New York; Howard E. Coffin, vice-president of the Hudson Motor Car Corporation and president of the National Aeronautic Association; Harold H. Emmons, president of the Detroit Board of Commerce; Dr. James W. Inches, Police Commissioner of Detroit; William E. Metzger, president of the Detroit Club, and Charles F. Redden, president of the Aeromarine Airways, Inc.

The Aeromarine Airways, Inc., is building for the trip a flying boat which will be equipped with beds, an electric range and radio. The observation compartment in the bow will be completely inclosed. The wingspread is to be 104 feet and two 400-horse-power Liberty engines, capable of making 100 miles an hour, will be installed. The machine will weigh seven and a half tons. The hull and cabin of the boat are almost finished.

The Canadian government has given its approval to the flight, and arrangements have been made with the Hudson Bay Company for the use of its posts as service stations. Montreal probably will be the first stop. Thence the voyagers will fly westward to the Ottawa River which, with a chain of lakes, provides a water thoroughfare to James Bay, a southerly arm of Hudson Bay. The route thereafter will lie across Hudsou Bay.

Virtually the entire route is above waterways, which will facilitate landing in case it becomes necessary.

"The idea of flying to the Hudson Bay district came to me recently," said Mr. Redden, "when I was flying over the Province of Quebec. I was impressed with the fact that there are innnmerable lakes and rivers affording an almost continuous waterway and landing field from New York to the Arctic Circle.

"Upon further investigation I found that traveling by dogsled or canoe, according to the season, a trip to the Hudson Bay region takes from six to eight weeks, and this means six or eight weeks of hardship too strenuous for any but the most experienced woodsmen.

"This led to the thought that inasmuch as the Wall Street banker and business man was going to the ends of the earth seeking new amusements it would be a good idea to take a party of sportsmen from New York into this northern territory."

Aeromarine Opens Southern Air Routes.

The first flight of the 1922-1923 season between Key West and Havana was made November 8th by the aeromarine 11 passenger flying boat SANTA MARIA. On the initial flight, the SANTA MARIA carried eleven passengers including C. F. Redden, president of the Aeromarine Airways, Inc., and Major B. L. Smith, General Manager.

On their arrival in Havana, the party received an enthusiastic reception. Prior to the reception, the president of Cuba had designated the Cuban Secretary of War Secretary of the Navy and the Secretary of State as his representatives and after the arrival of the SANTA MARIA these officials accompanied by C. B. Hurst, American Consul General in Havana made a flight in the SANTA MARIA above Havana and circled Morro Castle several times.

Mr. Redden made public in Havana the fact that the Aeromarine Company had already made plans to inaugurate a regular schedule from New York direct to Miami in the winter of 1923.

"We have had this service under consideration for the past two years and we have proved that we can take passengers aboard in New York after breakfast and get them into Miami in time for supper. This will be possible by relay work. For instance, one of our big 11-passenger air cruisers will go down the coast half way and there at some convenient airport, the passengers will be transferred after lunch into a scond aeromarine flying boat which will continue on down the coast."

The SANTA MARIA is the queen ship of the Aeromarine Airways' Black Tail Fleet. During this past summer the SANTA MARIA was one of a fleet of four 11-passenger enclosed cabin flying boats operating between Cleveland and Detroit on a double daily schedule.

Aero Club of Pennsylvania

The stated monthly meeting of the Club was held at the Air Field at Media, Pa., on October 21st. A large number of the members were in attendance. It was announced to the members that the Aero Club of Pennsylvania was represented at the recent Aero Congress by W. W. Kellett, a director of the Club.

The following pilots entered the Detroit races as Service Members of the Club. Captain St. Clair Streett, Lieutenant E. C. Whitehead and Lieutenant C. L. Bissell.

One of the important subjects which was discussed at the meeting was a method of making a drive for new members. It is felt that there are many people in and near Philadelphia, who are either directly connected witb the industry or who are interested in aviation who would join the Club if same was brought to their attention. It is important that we make an effort to enroll them in order to give them the opportunity and benefit of our Aero Club associations, and direct contact with the National aeronautic development and flying events.

Plans are being made so that at sometime in the near future, inspection trips will be arranged for members of the Aero Club to go through both the Naval Aircraft Factory at League Island and the dirigible hangar at Lakehurst, N. J., where the ZR-1 is under construction. Trips of this nature will do much to arouse interest and will give the members an opportunity to see the very latest in aircraft development.

Philadelphia must quickly develop a municipal landing field for airplanes if it does not desire to fall behind other large cities of the country, and eventually be passed by when the development of commercial aviation becomes more general. This is the substance of the recommendation made to the Philadelphia Chamber of Commerce by C. T. Ludington, delegate of the local body to the Second National Aero Congress in Detroit from which Mr. Ludington lately returned. W. Wallace Kellett, a member of the Chamber of Commerce Aviation Committee also attended the meeting. Mr. Ludington pointed out that Boston, Chicago, Kansas City and now Pittsburgh are providing landing facilities. A suitable landing field is an absolute necessity in Philadelphia.

The Media Air Field on which the club met on October 21st contains over one hundred acres and was turned over to the United States Government by the Media Business Men's Association to be used for military aviation purposes. Over twenty-five planes joined in the exhibition featuring the ceremonies. Governor Sproul addressed the 4000 persons who had gathered at the field to witness the dedication.

The Governor congratulated the business men's organization on its industry and public spirited interest. C. Frank Williamson, president of the association made the presentation. It had been expected that General Mason Patrick, head of the United States Army Air Service, would be on hand to accept the field as one of a series for army use. He was unable to attend and in his absence Major Brooks of Mitchell Field accepted the aviation field for the army. The flying field is on the Baltimore pike east of the borough of Media. It will be the western airgate of Philadelphia and is on the air route from Washington to Long Island. Planes were flown from Mitchell Field, Aberdeen and Bolling Field, Washington. More than two hundred army pilots took part in the event.

The army blimp, the D3 was anchored on the field and aroused much interest. Many types of planes including DH-9, DH-4, a Martin bomber, JN-4 and a Curtiss Oriole were on the field. Most of the planes used by the army pilots were driven by the famous Liberty motor. Following the official dedication the planes again took the air and gave an exhibition of formation and stunt flying. Later in

(Concluded on page 611)

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THE AIRCRAFT TRADE REVIEW

Aeromarine Airways Making Remarkable Progress

A communication received from the Aeromarine Airways states that its New York Division during the period commencing May 14 and ending October 22, 1922, carried 2,380 passengers, and that the Great Lakes Division, operating between Cleveland and Detroit, in the period commencing July 17 and ending September 17, 1922, carried 1,873 passengers. These figures are exclusive of crews. It is further stated that in 2½ years, the Aeromarine Airways carried over 17,000 passengers and covered more than 1,000,000 passenger miles, without a single serious mishap or injury to the passengers; also that during the past summer they had investigators in Europe who reported that, as far as comfort goes, Aeromarine flying boats are superior to any type of aircraft now operated on the European air lines.

In conclusion, it is stated that, so far as flying boat travel is concerned, the United States leads all foreign countries.

Taught to Fly in One Day

On September 22nd, 1922, Kenneth M. Lane, a student of the Dayton Wright Airplane Company, and who had never previously touched the controls of a plane, started to take instruction early in the morning, and that evening made his first solo flight. His total instruction time was four hours and twenty-six minutes, the remainder of the day being spent in ground instruction and resting.

The purpose of this experiment was to demonstrate the advantage for teaching and the superior flying qualities of the Dayton Wright "Chummy," a plane designed primarily for training, by Colonel V. E. Clark, chief engineer of the company and well known in aviation circles. The decision to conduct such a test was made as a result of numerous inquiries from prospective students as to how many days it would require to learn to fly.

Mr. Lane, who is 26 years of age, was chosen for the test because of two qualities which he possessed; education and an interest in athletics. The nature of his education was such as to develop mental alertness, while participation in athletics had developed the endurance necessary for the long day's grind.

The instructor, Walter E. Lees, since he started flying in 1915, has tested and instructed on many types of planes. The method of instruction employed has been worked out as a result of long experience and is a feature of this training school.

The plane itself is a two side by side seated biplane with a LeRhone rotary engine of 80 horse-power It is ideal for such work because of excellent flying qualities and the side by side seating arrangement which enables the instructor to observe the student continuously and conveys greater confidence to the student, because he knows at all times just what is happening and is told at the very moment why it happened.

Lieut. W. H. Brookley of McCook Field was official observer for the day, and Mr. C. F. Kettering, Mr. H. E. Talbot, Colonel Clark and others were interested observers that evening when Mr. Lane made his solo tests.

The Dayton-Wright Suit

In connection with the statements issued to the press at Washington to the effect that the Department of Justice has commenced suit against the Dayton Wright Airplane Company for the sum of $2,408,-267.41 alleged over-payment by the Government on contracts for aircraft production, H. E. Talbott, Jr., President of the Dayton Wright Airplane Company today issued the following statement:

The officials of the Dayton Wright Airplane Company wish particularly to emphasize the following points as to which there can be no truthful denial:

First, the contracts in question were formulated by the Government itself;

Second, they were performed under the Government's supervision and strictly as required by it;

Third, all payments made were voluntarily made by the Government upon the basis of its own accounting and its own interpretation of the contracts;

Fourth, a settlement contract was entered into after the conclusion of the work and after an audit of the accounts;

Fifth, no complaint of any description was made by any representative of the Government for seventeen months after this settlement had been made;

Sixth, no complaint of overreaching or fraudulent conduct or falsification of accounts has ever been made;

Seventh, and lastly, the Company paid to the Government approximately seventy per cent of its profits in excess profits and income taxes, a payment for which, of course, no credit is given either in the Government's statements or in its bill.

This suit, so far as anyone connected with the Dayton Wright Airplane Company knows, concerns in all of its important aspects merely the interpretation of the contracts under which the Dayton Wright Airplane Company turned out a great number of airplanes and spare parts for the Government during the war. All of these contracts were formulated by representatives of the War Department.

During the entire time of production under the contracts referred to, the Government representatives approved all purchases, inspected all material received, audited and approved all invoices and payrolls, and before the company could be reimbursed by the Government it had to procure a voucher signed by the Government Officer in charge.

Upon the termination of the contract a final audit of the accounts was made by Government representatives, who allowed or disallowed the claims presented by the Company, and a final settlement was made in June, 1919, evidenced by a termination or settlement agreement dated June 11, 1919, duly signed by both parties and approved by the War Department Claims Board, Air Service Section, on June 23, 1919.

During the latter part of the year 1919 and the early part of 1920, an Accountant representing the Liquidation Division of the Air Service, with a number of assistants, visited the Company's office and spent several months checking the records of the Company. On November 4th, 1920, seventeen months after settlement, the Company was notified of the action of the War Department Claims Board, Air Service Section, claiming overpayment by the

Instructor Walter E. Lees, and student Kenneth M. Lane who was taught to fly in a day.

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Government of $2,554,383.27, based on the general claim that certain of the contracts and contract provisions and the appraisal of the plant on termination of the contract were wholly or in part invalid in law, and the further claims that certain overhead items—principally special depreciation, representing the difference between cost of plant constructed for the purposes of the contract and the appraised commercial value of the plant at its completion (which value was fixed by a board of appraisers appointed one by the Company, one by the Government and the third by the two so appointed)—were improper charges to the cost of the 3,500 planes and large quantities of spare parts produced by the Company.

These payments and the appraisal had been made according to the provisions of the contracts between the Government and the Company and approved as fair and reasonable by the Government representatives who made the final audit and settlement in 1919.

The Government contentions, so far as they have been explained, are without exception based either upon pure technicalities or upon forced and finespun constructions of language which never occurred to anyone as intended by the parties or as possible until long after the contracts had been performed and settlements made. No claim of undue delay, poor work, over-reaching, falsification of accounts or fraudulent conduct of any kind has ever been made by the Government.

Upon completion of the settlement the Company, having no reason to suspect that the Government officials would endeavor to upset the settlement contract, had made the regulation Income and Excess Profits Tax Return, and had paid approximately seventy per cent of the profit in taxes, so that in the event the Government should be successful in proving in court its claim that these contracts, properly executed by duly authorized officers of the Government, are invalid, and that the Board of Appraisers did not properly perform their duty, the Company would have a valid offset for seven-tenths of the amount claimed.

Regarding the assertion that the Board of Appraisers did not value the property at its commercial value, the Company has been unable to obtain from the War Department Claims Board or from the Department of Justice any intelligible explanation of its reason for this or, for that matter, of any other of its findings.

It is a fact, however, that both before and after the appraisal, it gave the Government a written offer to sell the Moraine property, the principal plant, to the Government at the appraised value, and this offer, which was not accepted, remained open for acceptance by the Government from March, 1919, to October 15th, 1919.

The Dayton Wright Airplane Company welcomes the suit threatened by the Government as the only way to arrive at a final disposition of the matter, being assured by its Counsel that its interpretation, being the interpretation placed upon the contracts by the Government Officials during the entire period of their performance, is correct. The Company feels equally assured that the later action of the War Department Claims Board and the Department of Justice, which, without explanation to the Company, attempts to rescind the action of the same Board taken a number of months earlier, is wholly without justification.

UNITED STATES POST OFFICE DEPARTMENT
AIR MAIL SERVICE
Consolidated Report of Operation
Fiscal Year 1922

Month	Gasoline Cost	Grease and Oil	Repairs and Accessories	Misc.	Motorcycles and Trucks	Rent, Light Heat, Power Telephone and water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing and Experiments College Park	Radio	Departmental Overhead Charge	TOTAL
July, 1921	$ 15.314.14	$ 3.377.71	$ 20,312.72	$ 9,759.07	$ 3,966.08	$ 1.209.05	$ 9,304.52	$ 5,357.08	$ 14,636.14	$ 13,912.18		$ 9,629.07	$ 3,021.35	$ 109.799.11
August	14.711.17	3.513.53	20,948.14	9.014.39	4.215.42	1.205.92	8,323.45	5,574.94	14,764.20	15.008.99	$1,253.03	5,571.22	2,882.58	106,986.98
September	13.530.82	3.232.78	18,742.45	·8.690.28	3.941.77	1.725.59	9,280.02	5.415.87	14.329.58	14.773.75	763.31	5,772.40	2.799 83	102.998.45
October	13.858.03	3 065 53	25,881.32	10.924.35	3.831.34	1,532.59	10,765.41	5,749.65	15,513.58	17,093.25	743.11	10.447.26	2,800.09	122.205.51
November	12,657.50	3.060.19	26.380.19	8,480.47	4,107.96	2.530 96	10,312.85	5.769.61	14,903.85	17,464.04	636.24	8.193.56	2.900 09	117.417.83
December	12.116.94	2,717.64	31.513.17	7.868.73	5.050.69	2,920.92	10,539.83	5,809.06	14.666.63	14,705.01	604.78	6.955.35	2,795.95	118,264.70
January, 1922	11.352.66	2,385.52	32.545.25	8.630.80	3,?92.09	2.777 50	10,240.43	5.321.59	14.027.53	15,119.68		8.082.82	2,877.20	116,553.07
February	9,999.54	1,949.59	13.64?.65	6 714 21	2,75?.?3	2,962.59	10,425.79	5,133.58	13,338 58	11.374.75		5.893.75	2,706.14	86,898.29
March	11,835.47	2.349.07	17.027.91	7.100.15	3.013.69	2,489.19	9.598.74	4,853.36	14.601.21	14,662.97		5,750.16	2.603.02	95,884.94
April	10.786 45	2.079.33	7,645.68	5,198.51	2.893.19	1,926.09	9,938.24	4,500.51	14.235 24	12.633.27		5,404.52	2.825.02	80,066.05
May	11.531.44	2,225.10	6,334.90	4.942.35	2.650.78	1.823.19	9.533.66	4,298.46	14.757.65	12.993.87		5.537.32	2.962.50	79.611.22
June	11.313.14	2,221.25	5.760.48	4 869.82	4.052.35	1,726.86	9,670.92	1,800.00	14.632.61	13.150.11		6.189.99	3.093.33	78,480.86
TOTAL	$149,027.30	$32,177.24	$226.735.18	$92,193.13	$43.672.29	$24,830.45	$117.933.86	$59,583.71	$174.406.99	$172,891.87	$4,020.47	$83,427.42	$34,267.10	$1,215,167.01

UNITED STATES POST OFFICE DEPARTMENT
AIR MAIL SERVICE
Consolidated Statement of Performance
Fiscal Year 1922

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather Encountered: Trips in fog, etc.	Weather Encountered: Trips clear	Mileage Possible (Scheduled)	Miles Traveled With Mail	Miles Ferry and Test	Total Miles Traveled	Percent of performance	Mail Carried (Pounds)	No. of Letters Advanced	Cost of Service	Forced Landings due to Mechanical	Forced Landings due to Other Causes
1921																
July	624	623	1	6	65	558	131.450	130.555	18,129	148,684	99.31	77,276	3,091.040	$ 109.799.11	34	29
August	693	689	4	13	129	560	136,974	130,555	14.893	148,684	98.22	84,680	3,387.200	106.986.98	32	30
September	657	651	6	8	180	471	127,706	125.914	22,185	148.099	98 59	88,401	3,536,040	102,988.45	13	26
October*	714	707	7	7	166	541	140,080	138.759	20.212	158,971	99.05	99.057	3,962,280	122,205.51	23	21
November	672	633	39	46	285	348	131,520	117.529	25,616	143,145	89.36	93,519	3,740.760	117,417.83	17	74
December	726	660	66	37	266	394	142,240	125,416	15,840	141,256	88.17	101,198	4.047.920	118,264.70	42	46
1922																
January	699	633	66	32	191	442	136.880	119,966	17,721	137,687	87.64	93.283	3,731,320	116,553.07	31	44
February	635	558	77	15	210	348	124.960	107,944	10,140	118,084	86.38	92,902	3,716,080	86.898.29	24	28
March	729	690	39	22	269	421	144,720	134,503	16,161	150,664	92 94	123.212	4.928,480	95,884.94	13	57
April	675	632	23	16	276	376	134,000	127,634	6.369	134,003	95.25	116,202	4.650,100	20.066.05	17	69
May	702	694	8	8	235	459	139,360	136,973	12 312	149,285	98.30	121,888	4,875.520	79,611.22	17	46
June	702	697	5	1	161	536	139.360	138.185	9,770	147.955	99.15	132.904	5,316,160	78,480.86	18	9
TOTAL	8,228	7,887	341	211	2,433	5,454	1,629,250	1,537,927	189,338	1,727,265	94.39	1,224,723	48,988,920	$1,215,167.01	281	479

* Temporary Service from Elko to Ely, Nevada, inaugurated October 19, 1921.
** Last day service on Elko-Ely route, February 15, 1922.

PAUL HENDERSON,
Second Assistant Postmaster General.

(table concluded on page 618)

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ARMY and NAVY AERONAUTICS

Army Pilot to Try for New Record.

Brigadier-General William Mitchell, assistant chief of the Army Air Service, has recommended to his chief, Major General Mason M. Patrick, that the National Aeronautic Association of U. S. A. through the Secretary of its Contest Committee, B. Russel Shaw, at once arrange the details for officially timing and recording the flights of two Army pilots in a speed contest the intention of which is to better the world's record for airplanes over a one-kilometer course. The pilots designated for the contest are Lieutenants Russell L. Maughan and Lester J. Maitland, winners of the first and second places in the Pulitzer Race recently held at Detroit.

General Mitchell himself is the present holder of the world's record which the new contest is expected to exceed, having piloted an Army-Curtiss Race at Detroit, on October 16, at the rate of 224.38 miles an hour over a straight-away course of one-kilometer. The General used the plane flown by Maitland in the Pulitzer Race and, following his record flight, tested the plane for maneuvring, afterward testing the other plane, piloted by the first-prize winner, Maughan, in the Pulitzer Race, in the same manner, that is, looping, barrel-spinning, tail-spinning, and climbing.

These tests, together with the fact that in the Pulitzer Race Maughan had flown his plane 250 kilometers over a closed course at an average speed of 206 miles an hour, and Maitland in his had averaged 203 miles an hour over the same course, the General states, led him to believe that with minor adjustments to wings and engines these planes would be capable of even greater speed performances than those made at Detroit.

In accordance with this belief, the General has recommended the new trials, and, while the two pilots may use any plane they may desire, it is a foregone conclusion they will select the two racers used at Detroit. Consequently, while arrangements are being completed between the Contest Committee of the National Aeronautic Association and the Army Air Service for staging the contest, the two planes in question will be overhauled and put into top-notch condition by Air Service mechanics.

Army Considering Round the World Flight

Tentative plans for an attempted flight of army airplanes around the world have been under consideration for some months by Air Service officials, it was recently learned, but the project has not as yet passed the preliminary survey stage.

Valuable data on available routes in both directions have been obtained, however, and ultimately it is hoped to send a considerable aerial squadron on the voyage. The project will not be laid before Secretary Weeks for approval, it was said, until it takes much more definite form. Two of the routes considered are that from the Atlantic coast via Iceland and Ireland, and that from the Pacific via Alaska, the Aleutian Islands, Siberia and home via Ireland and Iceland.

Air service officials said the route offering the most favorable conditions as to prevailing winds would be selected, should the flight be ordered, and it would then become necessary to obtain permission of each of the countries to be traversed before the squadron could start.

Army flyers conceived the world circling flight plan in line with the reasons which prompted President Roosevelt to send the fleet around the world in 1908, it was said. It would have value both as a step in providing aerial defense through training and in giving the world a better understanding of American post-war developments.

Flyers of other nations have undertaken, up to this time without success, world girdling flights, but only with a single plane, while the American air service project would call for a fleet of aircraft and careful preparations involving considerable expenditures.

Study of Taking Off and Landing

One of the best known systems of flight instruction leave "taking off" and "landing" until the last, until even the acrobatics have been completed. One authority states that the majority of all accidents are caused in getting away or in returning to earth.

Mr. Carroll has prepared a study which is to be published by the N.A.C.A. In this he points out that here is a determining guide to the efficiency of any pilot. His ability in landing and taking off is a direct index of his efficiency and, perhaps, his longevity.

Two of the new instruments developed by the N.A.C.A. were used in his work—the accelerometer and the control position recorder. These show on a photographic film the complete record of the shocks sustained by the airplane in pancake and in perfect landings. The other instrument shows in the same manner the simultaneous operation of the ailerons, rudder and elevator in the operation of leaving the aerodrome or returning to it.

The author says of the application of these instruments: "They reveal to even the skilled pilot startling facts as to his technique. It is surprising to see an accurate record of his every movement of the controls in the air and the fluctuation of the loading and air speed which have given him but fleeting impressions while he was in the air."

Up to the time of the development of these and other recording instruments by

New type of Navy Seaplane that can be operated from the deck of Submarines — Harris & Ewing

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the N.A.C.A., designers and engineers had to depend much upon the memories of test pilots as to the performance of a particular airplane. The pilots' recollections were often vague and they frequently disagreed as to the same airplane, due, perhaps, to the personal equation. Today, however, a review by the flier of the finished chart enables him to recall his actions, the response of the airplane, and give a comprehensive report, which frequently adds much to the delineations on the chart.

In a pancake landing, intentionally made by Carroll by levelling off about six feet or so above the ground, the record of the blow showed that the plane hit the ground with a force of 4.5 times the weight of his craft. In careful and regular landings this force seldom exceeds 1.5 to 2 times the weight of the airplane.

It will be the province of the proposed federal bureau of civil aeronautics to pass upon the fitness of pilots who may be employed in the transportation of the public. The control position recorder instrument visualizes the relative skill of pilots in the execution of any maneuver whatever. It equals the Wasserman test of the physician. The human element is a vital factor in the matter of insurance. This and other new instruments measure flying skill in figures.

Construction of New Airship At Langley Field

The erection of the Airship C-14 is rapidly nearing completion, even though several unexpected difficulties were encountered in its assembly. On "weighing off" the ship, it was found to be tail heavy, which necessitated the moving forward of the car suspensions. This did not materially alter the existing defect. The surfaces were moved forward as an alternate method of remedying the uneven distribution of weight and several patches were replaced, together with a complete reassembly of the entire fin construction. This change in plans will retard the work several days from the date originally intended for completion.

The lift of the C-14 is estimated as being several hundred pounds in excess of the C-2, due to the fact that the envelope is approximately 10,000 cubic feet over-size. The envelope is considered by the officers in charge as having a rather poor general outline, as irregularities developed in the surface when inflated.

Tests flights are being carried on, and as soon as it is deemed practicable, the ship will be flown to Aberdeen Proving Grounds on its first cross-country flight.

Tracing the Movement of Troops

The 22nd Photo Section, stationed at Kelly Field, Texas, recently coöperated in the maneuvers held by the Second Division. A mosaic map of the area occupied by the troops of the Division was made one day when the area was occupied, and another was made the following day, after the troops had been withdrawn. Very satisfactory results were obtained, it being possible to trace the movements of the various regiments almost as well as though they had built roads to move out on, and proved to the officers of the Second Division the value of aerial photography in tracing the movements of troops. Of particular value was the proof of the ability of the K-1 camera, fitted with a K-3 filter, and using Panchromatic film, to pierce the haze so often encountered in aerial photography. The photographs were made at an altitude of 9,300 feet, through a dense haze which extended up to about 10,000 feet, and which rendered it impossible to pick out a point four miles distant with the naked eye. This point was some large, bright red building. Regardless of this disadvantage, however, the negatives obtained were clear and snappy. Captain Giffin piloted the photographic ship and Cadet Thomas made the exposure.

Towing Balls from Flying Airplanes

Adventure is introduced into drab science in the flying experiments of the National Advisory Committee for Aeronautics at Langley Field Memorial Laboratory at Langley Field, Va.

"Towing full sized wings, struts and wooden balls from a flying airplane has its ups and downs," says Thomas Carroll, test pilot for the Committee.

Renewed flights have been made to determine the comparative properties of various wind tunnels by the dragging of various sized spheres through the air at actual flight speeds. Design data has been largely based on the wind tunnel experiments in France, England, Italy, Germany and America, in which tenth or twentieth scale models have been utilized. Each of these different laboratories gives a varying figure for the same thing, and quite naturally.

By the towing of spheres through the air, the actual conditions of flight in free air are reproduced and the results when compared with the wind tunnel figures show the relative accuracy of the work of any one tunnel.

The relation between the sphere drag in a tunnel and the drag when moving through unrestricted air has not previously been measured, due to experimental difficulties. However, the comparison between wind tunnels and actual flight is very important, for the chief use of wind tunnels is to tell us what will happen in flight; so that it is quite necessary for us to know how far the tunnel results depart from the truth.

In view of this, the N. A. C. A. set its engineers to work to devise a method of testing the drag of spheres in free air. These wooden balls are from four inches to forty inches in diameter and are suspended, when being tested, by a fine wire from airplanes in flight, with instruments to measure the angle of the wire with the vertical. Knowing this angle and the weight of the sphere, it is an easy matter to calculate the drag of the sphere itself.

These spheres are not merely just plain balls, but they must be accurately spherical and their surfaces must be highly polished, for irregularity would create eddies and give erroneous values of the drag.

The airplane must be flown horizontally and at a constant speed during these tests and this requires a skilled pilot. It is also necessary to fly when the air is smooth, else the sphere will swing about like a giant pendulum and, if care is not taken, become uncontrollable. It would be mighty unpleasant to have one of these large balls swinging about at the end of a wire, thinks Mr. Carroll.

Left to right:—G. G. Albertoni, chemical engineer who will act as interpreter; Umberto Nobile, Chief Aeronautical Engineer for the Italian government; C. H. Zimmerman, aeronautical engineer.

Taken on arrival of M. Nobile at Akron, Ohio enroute to the Goodyear Tire and Rubber Company for whom he will be consulting engineer in the construction of the giant 300 ft. semi-rigid airship soon to be built by Goodyear for the United States War Department.

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REVIEW of WORLD AERONAUTICS

European Air Traffic

Traffic on the Continental airways reached a record figure during the month of August. Not only did the numbers of machines flying to and from Croydon surpass any previous monthly figure but the numbers of passengers travelling by air and the weight of goods transported also exceeded the highest totals hitherto recorded.

As compared with July, when the passengers on all routes were 1591, the August travellers increased by more than 1000, the exact number using air services being 2682. The previous best monthly figure was 2,021 in August of last year.

It is satisfactory to note that the British Companies carried the largest proportion of this traffic, their share slightly exceeding 82 per cent of the whole, while the French and Dutch Companies between them received only about 18 per cent. A year ago the British Companies' proportion was just over 45 per cent, so that there is not merely an increase in numbers but also clear indications of the preference of air travellers for British operated services. The number carried by British lines was 2,203.

The weight of air borne goods also rose to 77.8 tons, an increase of several tons on the July figures which were a record. A special feature of this traffic was that there was a daily average of slightly more than one ton of newspapers from London to the Continent during the month. Nearly the whole of the outgoing newspapers were carried by British aircraft. Incoming newspaper traffic was small in proportion, but the total newspaper traffic weighing 37.4 tons formed the largest class of goods transported by air. Other goods traffic amounted to 40.4 tons of which British and French machines each took 17 tons. Dutch aircraft carried in all 6.4 tons.

The number of machines flying on the Paris, Brussels, and Rotterdam services increased to 912 from 711 in July, a figure which was itself a record. The daily average of machines was therefore over 30. British Companies operated 598 of the total while French firms' machines numbered 210 and the Dutch Company accounted for the remainder of 104. The number of departures from the London Terminal Aerodrome, Croydon was 457 and the arrivals 455.

The efficiency of British operated machines was again very high, over 95% of the flights by British aeroplanes on the London-Paris route being completed within the stipulated period of four hours while practically 90% of the flights were made in less than 3 hours.

The percentage of useful passenger accommodation and general cargo space utilised during the month on British aircraft was 48%, which is a slight increase on the proportion during July.

The approximate distance flown by aircraft during the period was 185,000 miles, of which 115,000 miles were covered by British machines. On the London-Paris route, British and French machines flew 132,000 miles, while 30,000 miles were covered between England and Belgium, and 23,000 on the London-Rotterdam route.

There were no casualties or injuries to passengers or crews during the month.

French Airships Must Have Certificates of Navigability

Airships were moved a degree further toward receiving the same treatment as warships by the publication Oct. 22 of a decree in the Official Journal dealing with their certificate of navigability.

The decree, which came into force Nov. 15, declares that the certificate of an airship remains in force only so long as it possesses a rating certificate from the Bureau Veritas, which is the French equivalent of Lloyd's, certifying that the technicians of the Veritas Bureau have found the airship in a good state of navigability.

Airship Line From Sevilla to Buenos Aires

According to articles appearing in the current press, the proposed airship line from Sevilla, Spain, to Buenos Aires, Argentina, will start operations in the not distant future. In Sevilla and Buenos Aires the installation of airdomes is about to be started. Three hangars will be built in Sevilla—two to house three Zeppelins, and the third one to shelter a dirigible of smaller size, which will cover the route from Sevilla to the Canary Islands, carry 29 passengers, and will cost 500 000 pesetas.

Of the hangars to be constructed at Sevilla, the largest will measure 300 by 90 by 50 meters, and will be the station shed. The other two will measure 300 by 50 by 50 and 150 by 50 by 50 meters, respectively. The first of these last two is to be used for repairs to ships, and the second to shelter the training ship. The regularity of the winds in the region is unusual, and for that reason it is expected that no serious difficulty will be encountered in landing and entering these sheds, which will be fixed in direction. On the other hand, in Buenos Aires the winds are more variable in direction and greater in velocity. A revolving shed is projected, measuring 280 by 50 by 50 meters, and another, fixed in direction. The first one can be turned in any direction, and this will facilitate the operation of landing. An alternative idea is to have a circular shed, measuring 350 meters in diameter, equipped with 16 doors.

Three of the four ships to be built will be of 135,000 cubic meters capacity, 250 meters long and 33.8 meters greatest diameter. The fourth will be of 30,000 meters capacity, 144 meters long and 21.1 meters in diameter. The big ships will carry nine motors of 400 h. p. each, mounted in independent cars. The ship will carry 40 passengers, besides the crew, and eleven tons of mail or freight. The economical speed will be 110 kilometers an hour, and the maximum speed 132. Two of the motors will be kept in reserve, and it is not contemplated that the other 7 will be in use all at the same time, except in case of heavy opposing winds.

The quarters for the pilots and officers of the ship, the saloon, the kitchen and the smoking room will be in the forward part. It is expected to make a trip in each direction each week. The western trip, it is calculated, will require 3 days and 16 hours, but the eastern trip 4 days and 6 hours, due to the fact that atmospheric conditions are less favorable. The cost of the trip will be 10,000 francs, and the round trip may be made in seven days. A mail service is to be included, and the postage on a letter from Sevilla to Buenos Aires will be 3 francs and 75 centimes.

The whole project is the idea of Major Herrera, and was worked out by him during the war. His studies indicate that the 10,000 kilometers can be easily traversed in a single flight.

After the preliminary studies and calculations were completed and reviewed, General Echagne presented the project to the League of Nations, which gave it effusive praise. No action was taken, however, for various reasons, among them the fact that the Argentine Republic was not represented in the League. The King of Spain is deeply interested and enthusiastically in favor of the realization of this scheme.

The company has been formed, including among others the Senores Berreatua and Rementerias and as President, Senor Goicoechea, the former Minister. After further study in consideration of the project and the figures, Senor Goicoechea, with three of these experts, made the trip to Buenos Aires. There the Spanish project was received by the Argentine Republic and by Colonel Mosconi, Chief of

The New Type L-57 Albatros, equipped with 240 H.P. Rolls Royce engine.

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the Aviation Service, with the greatest enthusiasm.

The total expenditures for material, pay of personnel, construction of the ships and of the sheds, etc., amount to approximately 100,000,000 pesetas. According to Senor Herrera, the ships will be of a new type. As shown by the experiments of the Zeppelin factory during the war, no danger or difficulty is apprehended from storms. For the past five years there has not been a single accident in the daily air service in Germany.

The development of this service will be a favorable impulse to the national industry. In the beginning German pilots will be employed on these ships, and the materials of construction, including that for the frame, which is an aluminum alloy, will be imported from Germany. It is expected, however, that this material will be later produced in Spain.

A Monument to a Pioneer Aviator

There was recently unveiled at Cap Blanc Nez, France, a monument erected to the memory of Hubert Latham, the famous French pioneer aviator, who will be remembered for his flying in England in the early days of aviation, and who made two attempts before M. Bleriot to fly across the English Channel. In this he failed, and when rescued from the water on the second occasion, July 27, 1909, was calmly seated on his machine smoking a cigarette. Mr. Latham was killed in French Congo in 1912 while hunting wild buffalo.

Americans will recall this nervy little airman and his famous Antoinette monoplane in which he made several exhibition flights in this country. Natives of Baltimore, Md., no doubt still remember that eventful day, November 7, 1910, when they were thrilled by his 42-minute flight over the city for the prize of $5,000 offered by the Baltimore SUN.

Aerial Route Between Italy and Egypt

On the arrival in Italy of one of the four large hangars of 2500 m. which Germany has to deliver to Italy, Mr. Gino BASTOGI proposes a great airship route, starting from Milan with stops at Rome—Tripoli—Bengasi and ending with Alexandria, Egypt.

The distance of Km. 540 from Milan to Rome would be made in 6 hours passing over the Giovi at little over 1000 meters and then over the water. This would be better than the entire air route which, although 50 Km. shorter would compel a greater altitude from the Piacentino mountains to the roman territory.

The distance of Km. 1020 between Rome and Tripoli would take about 10 or 11 hours; all maritime route, therefore the best. At present it takes 3 days from Rome to Tripoli and four days from Milan.

The distance of 680 Km. Tripoli and Bengasi could be made in seven hours, great advantage in comparison with the present means of communication, exclusively maritime and therefore five times slower than the airship.

The last lap of Km. 980 from Bengasi to Alexandria would take 10 hours; following the coast, with a short flight across the Cyrenean plateau with elevation of not more than 300 m.

The chronological advantage of the route would be reached at Alexandria, Egypt; where there are many rich Italians who come often to Italy for business or pleasure, making the trip on fast steamers which take 5 days to Rome or Milan, costing about Lire 4000 while with the proposed aerial route would take less than 2 days and would cost Lire 2500 and little more for the food.

Beside the Italians and Egyptians, everybody going to and from Europe and further than Suez Canal, will take advantage of the three days gain offered by the aerial route, as Milan is the crossway of all the fast railroads leading to France, England, Belgium, Holland and Germany.

Even the mail, all of it, or the stamped, could be carried with profit: 10 000 letters could easily find place on board, without disturbing the passenger's baggage and special merchandise.

There will be room for 30 passengers and the speed would be from 90 to 110 Km. corresponding to half of the power. The speed of 125 Km. which can be developed constitutes a remarkable margin to make up for delays or for climbing up to 10 m. per second.

A Prize for Papers on Airships

The Council of the Royal Aeronautical Society have decided to institute forthwith from the funds of the R.38 Memorial Research Fund, an annual prize for a technical paper on Airships. The regulations covering the award of this prize are given below, from which it will be seen that the date for the receipt of the names of intending competitors for the first award is December 31st, 1922, while the papers themselves must reach the Secretary on or before March 31st, 1923.

From the income of the above Fund, a sum of twenty-five guineas will be offered annually as a prize for the best paper received by the Royal Aeronautical Society, on some subject of a technical nature in the science of Aeronautics. Other things being equal, preference will be given to papers which relate to Airships.

The prize is open to international competition. The Royal Aeronautical Society retain the right to withhold the prize in any year, if it is considered that no paper is of sufficient merit to justify an award.

Intending competitors should send their names to the Secretary of the Royal Aeronautical Society, 7 Albemarle Street, London, W.I. on or before December 31st of each year, with such information in regard to the projected scope of their papers as will enable arrangements to be made for their examination. The closing date for the receipt of papers will be March 31st in each year.

Papers should in all cases be typed, and a copy should be retained by the Author, as the Society can take no responsibility for the loss of copies submitted to it.

Successful papers will become the absolute property of the Society, and will in most instances be published in the Society's Journal. In regard to unsuccessful papers, the Society retains the right of publication in its Journal, but in each case will notify the Author shortly after the award, whether it intends to exercise this right: if not, the Author will be free to publish elsewhere. A signed undertaking must accompany each paper, to the effect that the publication has not already taken place and that the Author will not communicate it elsewhere until the Society's award is published. Due acknowledgement must be made by the Author of the source of any special information.

International Commission for Air Navigation

The International Commission for Air Navigation, established by the International Air Convention which governs Civil Aviation, have concluded a very successful Session in London. Sessions are held three times a year, in February, July and October, the first having taken place in Paris last July following the ratification on June 1st of the Convention signed on October 13th, 1919 in Paris.

At this Second Session the following were among the subjects discussed:—

(1.) The amendment of Article 5 of the Convention, which prohibits, except by special and temporary authorization, the aircraft of a non-contracting State from flying over the territories of contracting States, proposed by the French delegates, was accepted in principle. This proposal is that individual agreements may be drawn up between them contracting and non-contracting States, authorizing international air communication between them provided that the general regulations of the Convention are conformed to. It will now be necessary to obtain the ratification of this amendment by the various contracting States.

(2.) The system of voting on the Commission, which gives a preponderance of votes to certain Great Powers, and therefore has tended to discourage other States from becoming Parties to the Convention, was reviewed at the request of both the British and the Belgian delegations. The proposals for the removal of this difficulty was sympathetically received

The 1923 Model Farman 2-Seater Touring and Sport Plane. It is equipped with a 50-60 Anzani Air cooled motor.

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by the whole Commission and will be explored by the several Governments before the next Session.
(3.) Minimum international standards for airworthiness certificates.
(4.) The medical examination of pilots and other air personnel.
(5.) A system under which aircraft registration letters and wireless call letters would be the same.
(6.) A revision of the regulations as to signals and log-books.

The Third Session will be held in Brussels towards the end of next February on the invitation of the Belgian Government.

Between the Sessions the Sub-Commissions Operational, Wireless, Meteorological, Medical, Legal, Maps continue their activities.

Japan Institutes Aerial Mails

Flights in Japan's first air mail service, to run between Tokio and Osaka, a distance of 450 miles, were attended with fair success Nov. 3. The weather was perfect. One air postman flew from Osaka to Tokio in three hours. Another made the trip from Tokio to Osaka in four hours.

Commercial Aviation in South Africa

The South African Airways Co. (Ltd.), whose capital of £200,000 is being subscribed in England, has been organized to inaugurate commercial aviation in South Africa. Government assistance in the form of free training of pilots, free landing grounds, hangars and aerodromes when available, repairs and supplies at cost, as well as co-operation with the postoffice in the transmittal of letters and parcel post, is anticipated if the company attains a financial status satisfactory to the Government.

It is intended at first to concentrate on the main route from Cape Town to Johannesburg, and the company hopes to commence operation by the end of 1922. This route will be worked in three relays with 12 machines having Rolls-Royce engines. After establishing the main route, it is planned to extend the service from Johannesburg to Durban, a flight of three hours. It is proposed to run a Cape Town-Johannesburg-Pretoria service once daily in each direction, and the Johannesburg-Durban service twice daily each way, except Sundays and Holidays.

Obstacles to the success of this project lie in the great distances and sparseness of population and in the high operating costs.—Commerce Reports.

Non-Stop Berlin-Moscow Flight

Joachim Styllbrock, a German airman, recently accomplished a notable feat in aviation when he made a non-stop flight from Moscow to Berlin, a distance of 1,115 miles, in 18 hours. He piloted a Fokker R-4, fitted with a Rolls-Royce engine, and had as his passengers the Russian representatives in Berlin, M. Krestinski, and two government officials. The machine traveled over the towns of Vyasma, Smolensk, Vitebsk, Polotsk, Dunaberg, Kovno, Konigsberg, and thence to Berlin.

French Government Cooperation

Vice Consul John F. Simmons, Paris, in a recent issue of Commerce Reports (U. S. Dept. of Commerce) states that the French Government renders very practical assistance to airplane manufacturers in their efforts to develop new types of aircraft. The "Service Technique" outlines the type of craft desired, and any manufacturer may submit a design, according to the conditions specified. If the manufacturer's type is selected, the firm receives a trial order; and if the craft is successful the firm receives an additional order with the assurance that no manufacturer will produce its type of craft without paying the firm a royalty. Thus each manufacturer is induced to produce original designs, as he knows that quantity orders will be given to his firm and not to a rival who, not having had to bear the cost of experimenting, might be able to underbid him.

The "Service Technique" passes on all models, the tests being made at one of the best equipped laboratories in the world, located at Issy-les-Moulineaux. These laboratories are all new and the largest wind tunnel which has yet been constructed will soon be put into operation at Issy. Aviation is also encouraged by a large number of cash prizes offered by the Government, the aero clubs, and various individuals for flying feats.

Announcement has been made by the French Aeronautical Chamber of Commerce to the effect that the Aero Show will be held at the Grand Palais, Paris, from December 15, 1922 to January 2, 1923.

New Scandinavian Record

A new altitude record for Scandinavia (23,293 feet) was recently established by Lieut. Gottenburg of the Norweigan Army Air Service, accompanied by a passenger. Both were provided with oxygen apparatus. The former record was 16,732 feet.

Airships Five Times Bigger Than Zeppelins

Engineering data now available indicates that the next commercial airship will be monstrous in size, even to seven or eight times the size of present-day airships of the German type. Practice in the building of giant airships has shown that there is continued advantage in increasing the cubic capacity of the gas containers, which means a smaller volume of gas per passenger carried, a smaller weight of fuel per passenger, which means a lower rate of transport.

Recall the Schutte-Lanz of practically 2,000,000 cubic feet capacity, 650 feet in length by 75 feet in diameter, carrying a useful load of 39 tons, driven by 1200 h. p. at a speed of 64 miles an hour.

The useful load is 58 per cent of the total. The useful load of the Junker airplane, probably one of the most efficient in this country, is 36 per cent of the total. There is no longer any argument as to the sphere of the airship for economical long-distance transportation.

It is difficult to conceive the gigantic proportions of an up-to-date air liner of 10 000,000 cubic feet capacity.

This advantage in the continued increase in cubic contents persists as far as engineers have figured, and they have extended their calculations to ships of over 14,000,000 cubic feet of gas capacity, where nearly 3 passengers can be carried for every 39,000 feet of gas.

However, Colonel Crocco, one of the greatest authorities in airship design, a pioneer experimentor in Italian aeronautics, states that there is "an optimum value of the ratio between the useful load and the total load at about 270,000 cubic metres (9,554,490 cu. ft.), and that practically the increase of cubature beyond this limit and even up to it, hardly compensates for the greater commercial risk incurred by the concentration of tonnage."

In other words, it would be a better business proposition to operate two ships of 7,000,000 cubic feet than one of fourteen.

The General Air Service, which proposes to operate three ships between New York and Chicago, figures on craft of the moderate size of 4,000,000 cubic feet, which is twice the size of the largest airship built to date.

For a very complete bibliography of books on airships, see Army Air Service Information Circular (Aviation) No. 21, "Aeronautical Book and Magazine List," available by reference only.

Are German Aircraft Engines More Efficient?

Allied aircraft pilots who were pitted against the enemy in the World War, as well as automobile engineers and everyone looking to the economization of air travel, are interested in the test of the 185 h. p. B.M.W. and the 300 h.p. Maybach engines. These were made in the altitude chamber of the U. S. Bureau of Standards where conditions of temperature and pressure can be so controlled as to stimulate those of any desired altitude. Both engines exhibited excellent full-load efficiencies.

The economy of the B. M. W. was found "superior to most engines tested thus far, even at a density corresponding to an altitude of 25,000 feet. Its low fuel consumption is the outstanding feature of merit."

Economy of air transportation in dollars and cents of actual carrying costs is now of absorbing interest in the consideration of possible air routes. There is, too, the economy in flying at high altitudes, made possible by the supercharger and the adjustable propeller. Every ounce saved in fuel means an increase in the useful "pay load."

While the efficiency of the engine is not the whole story, it is of interest to make a comparison between the best known American-built machine, the DH4 with Liberty engine—not motor—and the German-built all-metal Junker with the B. M. W. which has been flying in America.

Characteristics

	DH4	Junker SL
No. occupants	2	4
Weight empty, lbs.	2391	2317
Useful load, inc. fuel and oil, lbs.	1191	1288
Weight loaded, lbs.	3582	3605
H.P. about 1400 r.p.m	400	243
Useful load per h.p., lbs.	2.971	5.30
Ground speed at about 1400 r.p.m., m.p.h.	120	111
Endurance, one charge, hours	2.6	5.30

To arrive at a measure of efficiency, in a popular way, one can take the fraction 111 over 120 (speed comparison) and multiply it by the fraction 5.30 over 2.97 (load per h.p. comparison) and find that the DH4 is but 63 per cent as efficient as the Junker.

True, the DH was not built as a passenger-carrier but as a certain type of war machine. But the fact remains that we have not in this country in actual service a machine that will outstrip the B. M. W. in economy of performance.

With the present great interest in the possibility of passenger air lines and their expected stimulation through the proposed establishment of a federal bureau of civil aeronautics, the question of economy in actual cost per ton-mile is vital.

Exhaustive information on the performance of the Maybach and B. M. W. engines may be had in N. A. C. A. Reports 134 and 135.

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"Technical Notes" of the N. A. C. A.

THERE has been printed in the November issue of *Aerial Age* a complete list of the printed **Reports of** the National Advisory Committee for Aeronautics to that date. Following is a list of the "Technical Notes" of the Committee. These are prepared in mimeographed form, frequently with photostated illustrations, but owing to limitations of funds and the processes of publication, these are not always available in sufficiently large quantities to meet any very great demand. However, they may be found in a number of libraries or may be obtained on loan from the Committee, at the New Navy Building, Washington, D. C.

These and other lists of Government documents are being printed by *Aerial Age* with the idea of making available either by possession or loan all possible information on aeronautics.

New reports and notes of the Government and new books, of course, will be noticed from time to time in the pages of this journal.

No.

1 Notes on Longitudinal Stability and Balance, by Edward P. Warner, N.A.C.A.

2 Airplane Performance as Influenced by the Use of a Supercharged Engine, by George de Bothczat, N.A.C.A.

3 Notes on the Theory of the Accelerometer, by Edward P. Warner, N.A.C.A.

4 The Problem of the Helicopter, by Edward P. Warner, N.A.C.A.

5 Relation of Rib Spacing to Stress in Wing Planes, by A. F. Zahm, Bureau C & R, Navy Dept.

6 Static Testing and Proposed Standard Specifications, by Edward P. Warner, N.A.C.A.

7 Notes on the Design of Supercharged and Over-Dimensioned Aircraft Engines, by Otto Schwager. Translated from Technische Berichte, Vol. III, Sec. 5, by George de Bothezat, N.A.C.A.

8 Duralumin, by E. Unger and E. Schmidt. Translated from Technische Berichte, Vol. III, Sec. 5, by Starr Truscott, Bureau C & R, Navy Dept.

9 Theory of Lifting Surfaces. Part I, by L. Prandtl, 1918. Translated from the German and abstracted by W. Margoulis, N.A.C.A.

10 Theory of Lifting Surfaces. Part II, by L. Prandtl, 1919. Translated from the German and abstracted by W. Margoulis, N.A.C.A.

11 The Problem of the Turbo-Compressor, by Rene Devillers. Extract from "The Internal Combustion Engine." Translated from the French by Paris Office, N.A.C.A.

12 Recent Efforts and Experiments in the Construction of Aviation engines, by Otto Schwager. Translated from the Technische Berichte, Vol. III, No. 5, by Paris Office, N. A. C. A.

13 Soaring Flight in Guinea, by P. Idrac. Translated from the French, by D. L. Bacon, N.A.C.A.

14 Increase in Maximum Pressures Produced by Preignition in Internal Combustion Engines, by S. W. Sparrow, Bureau of Standards.

15 Tests of the Daimler D-IVa Engine at a High Altitude Test Bench, by W. G. Noack. Translated from Technische Berichte, Vol. III, Sec. 1, by Paris Office, N.A.C.A.

16 Experience with Geared Propeller Drives for Aviation Engines, by K. Kutzbach. Translated from Technische Berichte, Vol. III, Sec. 3, by Starr Truscott, Bureau C & R, Navy Dept.

17 Italian and French Experiments on Wind Tunnels, by William Knight, Paris Office, N.A.C.A.

18 The Dynamometer Hub, by W. Stieber. Translated from Technische Berichte, Vol. III, Sec. 6, by Technical Staff, N.A.C.A.

19 The Steadiness Factor in Engine Sets, by W. Margoulis, Paris Office, N.A.C.A.

20 Notes on Specifications for French Airplane Competitions, by W. Margoulis. Translated from French, by Paris Office, N.A.C.A.

21 Drag or Negative Traction of Geared-Down Supporting Propellers in the Downward Vertical Glide of a Helicopter, hy A. Toussaint. Resume translated from the French, by Paris Office, N.A.C.A.

22 The Photographic Recording of Small Motions, by F. H. Norton, N.A.C.A.

23 Horizontal Buoyancy in Wind Tunnels, by A. F. Zahm, Bureau C & R, Navy Dept.

24 Development of the Inflow Theory of the Propeller, by A. Betz. Resume translated from the German, by Paris Office, N.A.C.A.

25 Center of Pressure Coefficients for Aero foils at High Speeds; by Walter S. Diehl, Bureau of Aeronautics, Navy Department, Washington, D. C.

26 A Variable Speed Fan Dynamometer, by Karl D. Woods, Bureau of Standards.

27 Instrument for Measuring Engine Clearance Volumes, by S. W. Sparrow, Bureau of Standards.

28 Loads and Calculations of Army Airplanes, by Stelmachowski Translated from Technische Berichte, Vol. III, No. 6, by Office of Naval Intelligence, U. S. N.

29 Progress made in the Construction of Giant Airplanes in Germany during the War, by A. Baumann. Resume translated from the German by Paris Office, N.A.C.A.

30 Design of Recording Wind Tunnel Balances, by F. H. Norton, N.A.C.A.

31 Crippling Strength on Axially Loaded Rods, by Fr. Natalis. Translated from Technische Berichte, Vol. III, No. 6, by Prof. Pawlowski, University of Michigan.

32 Causes of Cracking of Ignition Cable, by F. B. Silsbee, Bureau of Standards.

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(*Concluded from page 602*)

the afternoon several of the planes held a thirty mile race. Mr. and Mrs. T. Ellwood Allison entertained the army and navy officers and the officials of the Aero Club at a luncheon at tbeir home near the field.

Rear Admiral L. M. Nulton Commandant of the Philadelphia who attended with his staff also made an address.

W. H. Sheahan,
1st Vice President.

(*Concluded from page 600*)

compartments for tbe occupants, filled with fresh air of sea level density and there will be noticed no more discomforts than those of the every day Pullman while the advantages of air travel are startling. No click of the wheels over rail joints, speeds with trade winds of 200 or more miles an hour, no noise but the rush of air, no changing, panorama of Brobdingnagian proportions spreading out below.

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American Gliding Contests

IN ANSWER to an invitation extended by the Chamber of Commerce of Daytona, Florida, to the Aero Science Club of America, the first gliding and soaring flight competition in motorless airplanes in the United States will be held at the Ormond-Daytona Beach during next January. "The Aero Science Club of America has accepted," said Stanley Yale Beach, its secretary, to-day, "and has forwarded the invitation to the Aero Club of America and the National Aeronautic Association. The Aero Science Club will be glad to conduct the meet and hopes for an unequalled participation. We hope to make some new world records in gliding flight. The contest will be open to everybody. Motorless flying is true flying and nothing could be more effective in stimulating interest in aviation."

In the invitation from the Daytona Chamber of Commerce received yesterday it was stated that a thousand dollar trophy had been donated for the first American contest. It is hoped to add substantially to this inducement by other trophies and cash prizes. The National Aeronautic Association has expressed its interest in the matter and has given its assurance of co-operation.

The invitation was extended by the Daytona Chamber of Commerce after consideration of a report on the suitability of the Ormond-Daytona Beach for the proposed contest.

"In considering the enterprising offer of the Daytona Chamber of Commerce," said Mr. Beach, "the Aero Science Club of America took into consideration the fact that it would be necessary to wait until next summer if a meet were to be held near the great centers of population in the North. Such a delay would be deplorable in the face of the encouragement given to air flight in Europe. The Aero Science Club will urge the heartiest participation by all the Army and Navy fliers, airplane manufacturers, technical schools, independent fliers and its own members."

Although the Ormond-Daytona Beach has no hills such as were taken advantage of during the contest in Germany, sand dunes offer the finest place of all from which to glide, as was proven by the fact that all the early experimenters here, such as Octave Chaute, Avery, Herring and the Wright Brothers used them. Orville Wright was one of the first men to develop the art of gliding, although he has not flown a glider since he soared over a sand dune at Kitty Hawk for ten minutes in 1911 in a fifty-seven mile-an-hour gale.

As long as every one flies under the same conditions, it does not matter whether the starting point is high or not. To hold a competition it is only necessary to have a suitable spot. Without doubt, Ormond-Daytona Beach will be a first rate place to hold a contest for the reason that a strong breeze from the sea generally prevails in which some of the machines would be able to make true soaring flights.

In the event there is no breeze, trials can be made by towing by autos on the beach, each glider being towed a certain distance and at a given speed. The same should be done on the Indian River for the sea planes, or off shore when the sea is smooth for such craft as will stand the waves.

Long soaring flights can be made on the coast as well as inland. The flight of Capt. E. P. Raynham, an English aviator, of an hour and fifty-three minutes on October 17th, the second day of the London Daily Mail contest, was made with a simple monoplane of his own construction. Captain Raynham came to the meet with little expectations. He had hoped to remain in the air for three minutes. He remained for almost two hours. So little did he expect to do any soaring that his controls were so inconveniently arranged that by the end of the flight he was quite exhausted from holding them.

It is possible to soar over the water in one of these gliders as well as over the land, as shown by the recent experiments of Glenn H. Curtiss the inventor of the flying boat. There are many who are eager to compete in a glider contest, and at Ormond-Daytona Beach they will have their chance.

Model "D" Orenco

Following is a description of the Model "D" Orenco built by a student of the Shenandoah Valley Academy, Winchester, Va.

Dimensions

Span upper	30"
Span lower	27½"
Gap	44½"
Chord	55"
Length o.a.	21½"
Height	8¼"
Propeller	9" dia. x 8½" pitch

Wings

The upper wing is built as one unit, the spars being continuous throughout the length of the wing. This plane is built up of 19 balsa ribs, in which holes were cut for the spars which were inserted, and the ribs spaced 1½" apart thereon. The front spar is centered 13/16" from the leading edge, and the rear spar is 2½" from it. The front spar is 3/16" x 5/32", while the rear spar is slightly smaller, owing to the narrowness of the ribs at that point.

Ailerons are on the upper plane only, and these measure ⅞" x 1¼". The spars at the ailerons are beveled, providing a much neater hinge.

The lower planes are built up of 8 ribs each, and both wings have an edging of reed slightly less than 3/32" in diameter.

All of the struts are streamlined, and the fastenings for the wires are of aluminum, but a couple of turns of No. 32 gauge steel wire about the spar at each connection will be found much stronger and efficient, although it does not look as much like the real thing.

The covering is of very fine silk, doped and varnished. Wing section used is U. S. A. No. 15.

Fuselage

This is constructed in the usual way. At the rear, a permanent fastening is made of the tail-skid and a rear post for the fin, thereby eliminating wires from the empennage.

The pilot's head-rest is of aluminum, as is the cowl containing the cockpit forward to the motor. Here balsa wood has been used, cut to the form shown in the photographs, by which the outline of the dummy Wright motor could be most easily adhered to. Small paper tubes are used to simulate exhaust pipes.

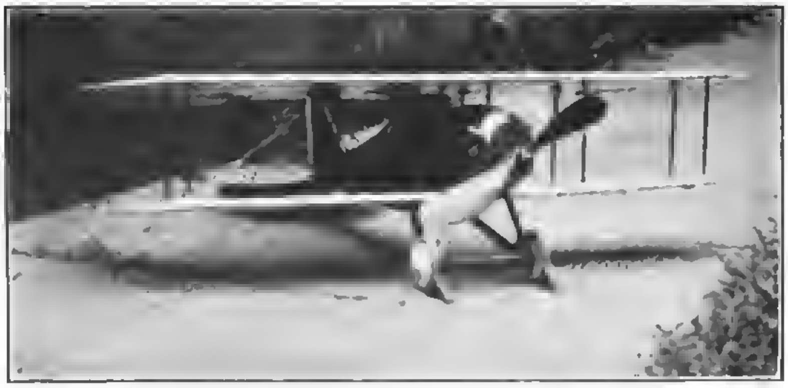
The radiator is cut from soft pine, and may be taken out. It is attached to the motor-stick, whose only other connection with the body is made by a piece of #34 wire about the center of the upper cross-piece at the back of the cockpit. Ten strands of 1/16" square rubber proved to be of enough power to fly the model R. O. G.

A piece of aluminum forms the under cowl, extending from the radiator as far back as the entering edge of the lower wing.

A small cap of balsa was placed on the propeller hub recently, which is not included in the length of the fuselage as given above.

Landing Gear

This is made of spruce, and is ½" x ⅛" except about the axle, where the joint was made at the vertex of each "V", and the



Model "D" Orenco built by an Aerial Age reader

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proper curve required a greater widtb. A rounded oblong hole 1/3" x ½" is provided for the floating axle, which is held in position by small rubber bands. Two cross-braces are used, also streamlining the axle.

The wheels are 2¼", covered with fabric and doped, being perfectly flat on the inside, but the fabric raised ⅜" at the hub on the outside.

The tail-skid fairing is balsa, while the hinged skid itself is of hard-wood with rubber shock-absorber.

Empennage

The fin is fastened to a post ⅛" square which is attached permanently to tbe fuselage, and is made up of balsa wood ⅛" thick and is covered and doped.

The rudder is made up in the usual way, with an edging of 3/32" reed, except that the upper rib which forms the lower edge of the balanced portion is built of two pieces of thin spruce ⅛" x 1/32", one of which goes on either side of the ⅛" round bar forming the hinge of the rudder.

The stabilizer has only the forward spar continuous and running through the fuselage. Its ribs are of ⅛" x 1/32", and pass on both sides of the spar, meeting at the entering and trailing edge, giving it a double-cambered surface, as in a portion of the rudder. It is adjustable, and has 3/16" play at the entering edge, as the spar is the only piece which enters the body.

The elevator, being single acts as a good brace for the rear of the stabilizer. It is easily built of one ⅛" round bar at the front, and edged with 3/32" reed, held in place by four ⅛" square balsa strips.

General

The entire fuselage, fin, and balanced portion of the rudder are given a coat of olive-drab enamel. The machine has the regulation U. S. Army insignia.

All doped surfaces, stabilizer, elevator, wings, and wheels, and all exposed wood, i. e., struts, landing-gear and propeller, are Valspared. Recently, however, the wings, elevator and stabilizer were enamelled cream.

The performance last summer proved far better than the builder had expected; it won first place among other scale models of the C. M. A. C. in Washington. It seemed balanced almost perfectly without moving the wings in the slightest, or changing the position of any of its surfaces, which is somewhat unusual for a scale model in whieh all dimensions of its prototype have been strictly adhered to. One great help is the solid block of balsa in the nose above the top longerons.

In flying against a 6 or 7 mile wind, its tail rises almost immediately, and it is off the ground before it has run 15 feet. It then rises at a good angle, and when the power gives out, lands easily.

Gliding and Soaring Flight

The gliding and soaring flights occupying the attention of Europe and America are the modern experimenters best means of bird-flight study. Gliding was practiced in the early days of aeronautics as the first step toward flying. When the motored glider or aeroplane became a reality, gliding was for a time quite abandoned as merely an elementary principle which needed no further development. Now it may seem odd for even professional pilots again taking up the sport of gliding and its later development, soaring, yet there are very good reasons for the return, as we shall sce.

Perhaps the greatest benefit to be derived by the accomplishment of true soaring flight is economy of power. Now altho man soon learned to fly through the air faster than any bird, the fact remains that man requires considerably more power in proportion to his accomplishment in speed. Of course the original problem was to fly at no matter what cost. Once the pioneers of aviation demonstrated that flight was possible, the tendency was to increase the speed of flight. It was found that for motored flight that safety lies in speed, up to a certain point. Therefore we have had speed development, best evidenced in the army Curtiss Racer which flies at more than four miles a minute.

It is not supposed that the glider, or soaring "sail-plane", will supplant the modern aeroplane any more than yachting would be expected to do away with the motor boat. But each has a purpose to serve.

To return to the early use of tbe glider—man learned to balance himself in the air, found out about air currents and the effects of the atmosphere on his craft and tested the value of various bird-like wing structures. When the powered glider came into existence, attention was directed principally toward perfecting the engines and tbe controlling mechanisms. Much research into the fundamental principles underlying flight was set aside in many instances because of the pressing demands of physical development. This is clearly brought out in the fact that from the time of the first flight, aircraft development made considerably greater progress in the same period of time than the automobile industry.

We are approaching the limit in speed for aircraft of the type we are familiar with today. Still there remains the economy factor, and it is through our gliding and soaring experiments that we must look for the solution of the low powered air vehicle which will rival the automobile in economy, ease of maintenance and operation.

In order to appreciate the problems and difficulties confronting the designer of motorless aircraft, it is well to touch upon some of the distinctions, principles, laws governing the various types of craft under consideration.

The Glider

The glider is the simplest form of aircraft. It comprises a surface which retards the downward movement caused by gravity, resolving it into a forward movement. In a glider, the path of flight is continually downward and forward due to gravity and pressure of air on the wings respectively. The most efficient glider is that in which the rate of descent is slowest. The gliding angle, therefore, is the angle of descent, and the greater this angle, the hetter the glider, for it means that greater ground may be covered in descending from a given altitude.

Birds glide at the rate of about 12 to 1; that is, for each foot of elevation, the bird skims forward 12 feet, with no power otber than the action of gravity. The modern aeroplane, when the motor is stopped becomes a natural gliding machine, and while tending always earthward it may travel forward in straight or circling paths at a rate of 8 feet for each foot of elevation. In other words, it moves forward eight times as fast as it does downward, assuming an angle of descent in that particular relation. Therefore a flat gliding path is desirable in any machine as it makes possible a wider choice of landing territory.

A glider, or aeroplane in which the motor is stopped, must descend at a rate of speed not less than that determined by its lift in relation to its weight, although for making a landing at predetermined places, within gliding distance the control surfaces permit of increasing this angle at will. In this manner, the angle of descent may be said to be variable, altho having a definite minimum angle.

With this in mind, it is easily seen how the gliding angle effects the range of action of an aeroplane in coming to the earth—a plane with a gliding angle of only 6 to one, beginning a glide at 100 feet, has available to itself a circular plot of ground 1200 feet in diameter, that is, 600 feet in radius, in which to affect a landing. On the other hand, a machine capable of gliding at an angle of 8 to one has a wider choice in selecting its landing place, as it may glide to any point within a 1600 foot circle below. Taking this 100 foot altitude for a comparison of two ships as this, we find that the plane which glides at 8 to one actually has ——— square feet more of ground in which to land. The amount of territory included by the flat-angle glider is proportionately greater from higher altitudes.

In gliding experiments, the glider is launched from an altitude, preferably a sloping hillside. Gravity carries it downward as it glides forward. Balance is maintained by the operator shifting the weight of his body slightly from side to side or fore and aft. In the more proficient gliders, controls similar to the conventional aeroplane are used.

A glider, then, may travel not further than a definitely fixed distance which is determined by its weight and altitude. Its field of operation is therefore limited.

There is another form of glider which has recently come to public notice. This is the "towed" glider—one which is towed through the air by means of a powered vehicle. Glenn H. Curtiss has designed a glider of this type. It has been successfully towed by a high speed motor boat and on another test was towed by a flying boat. The tests showed that "air-trailers" may become an important factor in future development of the glider.

Where a glider is towed through the air, the force which pulls the machine forward takes the place of the power supplied by gravity, and inasmuch as the pulling force is forward instead of downward (as in the case of gravity) greater lift is obtainable, and therefore horizontal and even lifting flight may be accomplished as long as the pulling force continues. As soon as the towing wire is released, and the forward pull discontinues, the "air-trailer" becomes a true glider and descends slowly under the influence of gravity. Gliders or "air-trailers" may be developed into soaring planes or "sail-planes", the characteristics of which are exceedingly more complex.

The "Soaring Plane"

The soaring plane may travel in all dir-

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ections, with or against the wind. It may rise and dip as various air currents are encountered. Altho it is acted upon by gravity, the peculiar forces utilized by its wings has greater effect than gravity, thereby making lifting possible.

All concurring air flows around a wing, (as the wings of a soaring bird) is not known, but there are some basic laws and phenomenon at the disposal of the sailplane designer. Tests have shown the paths followed by air passing around a wing surface. Wings of differing contours, direct the air flow in different ways, some in such a way that they cause more lift than others.

The lifting effect is produced by the distribution of air flow over the wing. The top side of a wing is arched, with its highest point near the front. Air passing over the wing (or the wing passing through the air, which has the same effect) is divided, some being directed above the wing and some below it. The air in passing over the curved upper surface is, we might say, "thinned out" or rarified to some extent. The air below the wiry curve remains at about the same density, and therefore the result is that the wing finds less resistance above than below, and lifting occurs. The phenomena is really more complicated than this explanation might indicate, but it gives a general idea of the function of the curved wing.

It will be seen, then, why so many wing contours have been experimented with. Each has its own peculiar traits and constant research is necessary to determine the contour most suitable to the work at hand.

As the lift required for soaring is derived from the movement of the air, naturally there can be no soaring in calm air. As soon as all movement of air ceases soaring quickly ceases and only gliding is possible. This explains the reason that certain localities have been selected by the German soaring plane experimenters, hilly places where air currents are almost continually in motion.

Air currents heated by the sun's rays reflected from the earth, seems to help the lift of a soaring plane. It is a fact that in warmer climates, birds are observed to soar continuously all day, depending absolutely on the air currents which becoming heated and rise, thereby giving motion to the air which in turn imparts the necessary lift to the wings. Soaring birds are unknown in cold climates. It has been observed that soaring is less common as darkness approaches in temperate climates, strengthening the theory that warm air currents are an important requisite for soaring.

(To be continued)

A Model of the Avro "Baby" Aeroplane

The model of the Avro "Baby Green" aeroplane was made from plans appearing in AERIAL AGE, September 1920 by Bruce Allan Mapes of Brooklyn. This ship won the London Aerial Derby, of that year and also flew from London to Turin, Italy a distance of 650 miles in 9½ hours, using only 20 gallons of petrol.

Dimensions of model:

Overall Length	26½"
Overall Height	10½"
Wingspread	37¾"
Wing Chord	5⅞"
Gap	6⅛"
Size of Prop. Diam.	12"
Size of Wheel	3"
Weight	12 ounces
Wing Curve	Sloane

Above: An Avro "Baby" model by Bruce Mapes Below: A 5 H.P. air-propelled ice sled built by H. B. Tenking.

The fuselage is built up from 5/32" longerons of spruce, and made in the standard fashion. I made the fuselage extra strong to stand a good deal of knocking around. The Turtle Deck is built up of Balsa wood framework. Forty feet of ⅛" flat rubber supply the motive power. The landing gear is made from ¼" round reed, with a streamline fairing of Balsa wood. Three inch wooden disc wheels with rubber tires are used with 1/16".

The outside of the wheels are covered with very thin silk and doped. This gives a very good streamline effect. The method of doing this is: the rubber tire is removed and glue or shellac is put on around the rim where the tire was. Spread the silk over the wheel and put on tire again. When the tire is on pull the silk through the opposite side and stretch it evenly all around. When the glue has set, dope the silk several times and you will have a fine streamline disc wheel. This may be done on both sides. The landing gear is also shock absorbing. The nose piece is painted on to correct form. The radiator cowling being painted on. The radiator is put on with white ink, on a black piece of cardboard. This is glued on the front, and then the radiator cowling being painted all around gives it a good effect. A twelve inch propeller is used.

The tail group is constructed in the usual manner with 3/32" reed for the edges, and ⅛" square pine for the frame work. The tail surfaces are movable but not from the pilots cockpit, as in any other models. The tail skid is of ¼" round reed.

The wings are made up of 3/32" reed for the leading and trailing edges, ribs being made of Balsa wood, with Sloane Wing Curve. The ribs of the middle wing is for strength. The wing spars are of ⅛" section and ribs fastened next the fuselage, are made of 1/16" three ply veneer. This spruce, slipped through holes in the ribs at the correct points and glued in place. There are 8 ribs in each lower wing and 7 in each upper wing, and four ribs in the M. W. S. The struts are ⅜" x 3/32" spruce and streamlined. The middle Wing Section Struts are raked outward. The wires are really very thin fishing cord. I think this is better than wire, and is neater and stronger, it is always taut.

The entire model is covered with bamboo paper, and doped with bamboo varnish. The cowling, landing chassis, tail skid and all struts are finished in light blue, the rest of the machine in natural color. The total weight is 12 ounces.

Models Built by Aerial Age Readers

The Curtiss JN4-D model built by R. Hopkins, E. 6th Ave., Redfield, S. D., is not intended to fly but the construction of the large machine is carried out in detail. It was built to the scale of an inch to the foot.

The wings are made in five sections. Spars are of spruce, the ribs are of basswood and are webb construction to secure lightness and to take internal bracing wires. Three-ply veneer is glued to the entering edge of the wings to make it rigid at these points and to keep the covering from pulling in between ribs. Each upper plane is composed of 18 ribs and each lower 14 ribs. There are two stringers thru each wing to secure stiffness. The wings are covered with silk and finished a light brown.

The inter-plane bracing is the same as on the large machine.

The fuselage is built up like the large machine and braced internally with wire, using small aluminum fittings painted black. Seats are leather-padded and have safety belts with small buckles. The following instruments are mounted upon the mahogany instrument board in the rear cockpit: clock, compass, tachometer, airspeed indicator, altimeter, and oil gauge.

In the rear cockpit there is a throttle lever, switch and hand operated pump that will really pump. The gasoline tank is made of three pieces of brass joined by soldeirng. A miniature gasoline gauge screws on the tank above the cowling. Edges of the cockpits are padded with leather.

The engine is a dummy OX-5 and is mounted in the engine bed by four small bolts. The crankcase is of wood. The cylinders were made out of rifle bullets of the type used in the army. Small valves and rocker-arms were soldered on the tops. The exhaust pipes are of brass tubing. Intake pipes and a dummy magneto are mounted between the cylinders. Cylinders and crankcase are painted aluminum. The engine cover can be easily removed by unhooking four small lips which hold it tight. The inspection doors swing on two aluminum hinges and are held closed by aluminum clips.

The propeller is eight inches in diameter and is made in five laminations. Radiator is of wood painted gold, the radiating surface being lined with ink.

It is equipped with dual controls. Each elevator aileron and the rudder are hinged by three aluminum hinges. The control horns are of aluminum.

The tail skid and under-carriage are equipped with elastic shock-absorbers.

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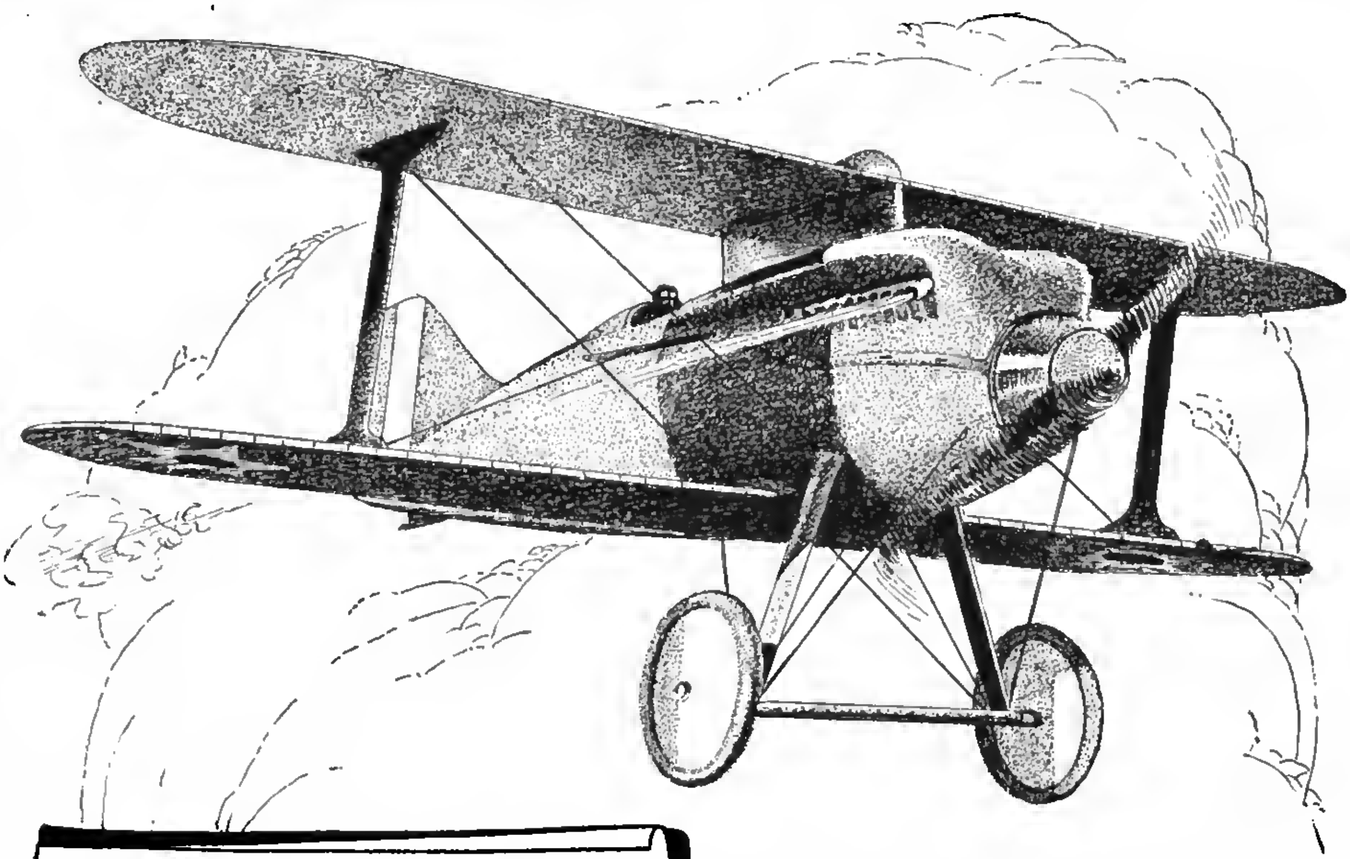

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Messrs. Valentine & Company
New York City

Oct. 17, 1922

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The high speed for which they were designed requires that special attention be directed toward minimizing skin friction. In this connection Valspar was selected. Not only did it serve to lessen the resistance and contribute to the speed, but at the same time the two Army-Curtiss Racers which won first and second places were voted the most attractively finished planes in the race.

Yours very truly,
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J A B Smith
Secretary and Treasurer

Faster than Human ever flew— and Valspar helped!

New honors for Curtiss Planes! First four places in the Pulitzer Trophy classic, with the winner averaging 206 M. P. H. over the 160 mile course—a new world's record. That was October 14th at Selfridge Field, Michigan.

October 16th another record went crashing. Lieut. R. L. Maughan, winning pilot in the Pulitzer contest attained the terrific speed of 248.5 M. P. H. over the one-kilometer course. Two days later Brigadier General Mitchell set an official world's record of 224.05 M. P. H. on the same course.

How important a part Valspar played in these victories is disclosed by the accompanying letter from the Curtiss Aeroplane and Motor Company. 100% waterproof, weather-proof and wearproof, Valspar is in a class by itself. It has no equal.

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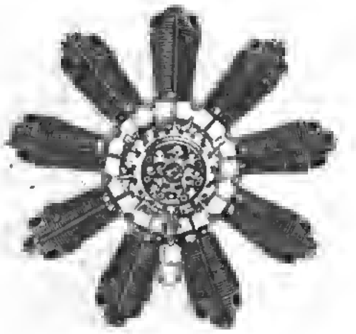

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The French Official Report States:—

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"Nothing to report. The engine behaved itself perfectly. There were no replacements of any sort in the course of the trials.

"It is regrettable that this test stops at 50 hours; this duration could have been doubled, which would have been a still better testimony to the engine."

BRITISH AIR MINISTRY TYPE Test, September, 1922

The Jupiter engine was the first air-cooled engine to pass this test, which comprised 50 hours' endurance test at 90 per cent. full power, one hour high speed, one hour high power, runs for power curve, etc. At the conclusion of these tests one hour was run at full throttle at 1,775 r.p.m., averaging 442 B.H.P., and one hour at 1,840 r.p.m., averaging 450 B.H.P.

FRENCH AIR MINISTRY TYPE Test, JUNE, 1922

The tests carried out at Gennevilliers included five non-stop runs of 10 hours each duration, the first half-hour of each period at full power, 9½ hours at 90 per cent. full power, with 2 minutes at full power at the close of each period. The average power recorded at the beginning of the periods was 413 B.H.P., and at the end 420 B.H.P.

The oil consumption was only 10⅛ pints per hour, and for the first time in the history of the French official tests the whole of the tests were carried out in 10-hour periods without adjustments or replacements of any kind.

The Bristol Aeroplane Company, Ltd.
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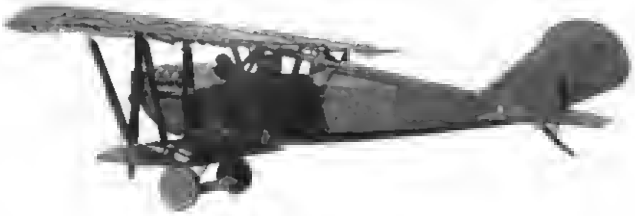
Cables:—Aviation BRISTOL



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Weight Empty	1125 Pounds	1215 Pounds
Useful Load	735 Pounds	750 Pounds
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Ceiling	12000 Feet	18000 Feet
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Minimum Speed	35 MPH	38 MPH

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(*Concluded from page 604*)

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- Rent, Light, Heat, Power, Telephone and Water
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- Miscellaneous
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- Warehouse

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- Gasoline and Oil
- Pilots

SERVICE AND UNIT COST

Month	Gal. of Gas	Time Hr.	Time Min.	Miles Flown	Cost per Hour	Cost per Mile
1921						
July	48,625	1644	26	148684	66.76	0.73
August	47,818	1696	30	149432	63.06	0.71
September	43,953	1667	07	148099	61.73	0.79
October	46,469	1779	32	158971	68.58	0.77
November	41,758	1602	31	143145	73.27	0.82
December	39,576	1532	26	141256	76.17	0.84
1922						
January	38,755	1491	22	137687	78.15	0.85
February	34,343	1274	58	118084	68.15	0.74
March	41,532	1640	20	150664	58.35	0.64
April	37,810	1453	53	134003	56.06	0.60
May.	41,022	1585	39	149285	50.22	0.53
June	40,970	1668	09	147955	47.05	0.53
Totals & Averages	205,631	19036	53	1727265	63.83	0.7035

COST PER MILE

Month	Overhead	Flying	Maintenance
1921			
July	.18	.22	.33
August	.16	.22	.33
September	.17	.21	.32
October	.20	.20	.37
November	.20	.21	.41
December	.20	.21	.42
1922			
January	.20	.20	.45
February	.21	.22	.31
March	.16	.19	.29
April	.17	.21	.22
May	.15	.19	.19
June	.17	.19	.17
Averages	.1783	.2058	.3194
Total			.7035

PAUL HENDERSON,
Second Asistant Postmaster General

AIRCRAFT YEAR BOOK

Edition of 1922

Published by Aeronautical Chamber of Commerce of America, Inc.

250 Pages Text; 40 Pages Illustrations; 40 Pages Aircraft and Engine Drawings

TABLE OF CONTENTS

CHAPTER

I Review of Commercial Aviation During the Year—Aircraft Demonstrate Practical Utility—Significance of Aircraft Battleship Demonstrations—Air Law in Sight—Aeronautical Chamber of Commerce Organized.........

II Problems of Aerial Transportation—Capital, Terminals, Reliability—Needs Which Can be Met Through Aerial Law—Report to Secretary of Commerce on Safety in Flight.....

III The Air Demonstrates Its Command of the Sea—The Battleship Bombing and Conference on the Limitation of Armaments..........

IV Review of Aeronautics Throughout the World, Nation by Nation................

V Technical Progress in Aircraft Construction During the Year.......................

VI Airships in Commerce...................

HISTORICAL DESIGN SECTION..............

APPENDIX

Commercial Section: Aeronautical Chamber of Commerce of America, Inc.; Manufacturers, Aircraft Association, Inc.

U. S. Air Service, War Department: Organization; Officers on Duty in Washington; Army Corps Areas and Departments; Stations and Activities.

Bureau of Aeronautics, Navy Department: Organization; Officers on Duty in Washington; Officers with the Fleets; Naval Air Stations.

Marine Corps, Navy Department: Organization; Offices, Aviation Stations.

Strength of U. S. Air Forces (Army, Navy, Marine Corps); Diplomatic Service of the U. S.; Air Attaches, War Department; Air Attaches, Navy Department; Diplomatic Service to the U. S.: Foreign Air Attaches; Aeronautical Board; Personnel and Committees; Helium Board; Board of Surveys and Maps, Department of Interior.

Aircraft Appropriations, Foreign; Aircraft Appropriations, U. S.; Military; Naval; Postal; Aircraft Production Cost, 1917-1918; Foreign Subsidies for Civilian Aviation Armament Conference Report on Aircraft.

Air Mail Service, Post Office Department: Executives; Air Mail Fields; Transcontinental Controls, Planes in Service; Consolidated Statement of Performances, May 15, 1918—Dec. 31, 1921; Forest Fire Patrol, Department of Agriculture; National Advisory Committee for Aeronautics; Organization; Summary of Report, President's Letter of Transmittal; Customs Regulations, Treasury Department; Public Health Service, Treasury Department; Aircraft Imports and Exports, Bureau of Standards, Department of Commerce; Bureau of Foreign and Domestic Commerce, Automotive Division, Department of Commerce; Air Law Section: Wadworth Bill, creating Bureau of Civilian Aeronautics in Department of Commerce; Fake Stock Warning. National Vigilance Committee; Associated Adve. tising Clubs of the World; Aircraft Insurance; National Aircraft Underwriters Association; Colleges and Schools Offering Courses in Aeronautics; Landing Fields and Air Terminals; Chronology for 1921; Remarkable Aeronautical Performances, 1920; World's Records, 1921; Trade Index.

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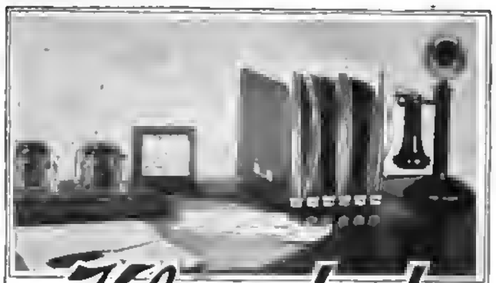

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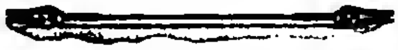

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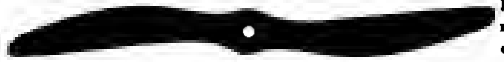

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AERIAL AGE

VOL. 16, No. 1 January, 1923 25 CENTS A COPY

Aviation and The Feminine Touch

Maintenance and Operating Equipment of Airplane and Seaplane Stations

Flying Between Canada and the United States

England Builds Giant Torpedo Plane

AVIATION PAYS ITS WAY

A noteworthy article by Conway W. Cooke, showing clearly how other industries are benefitting through aeronautic research and development.

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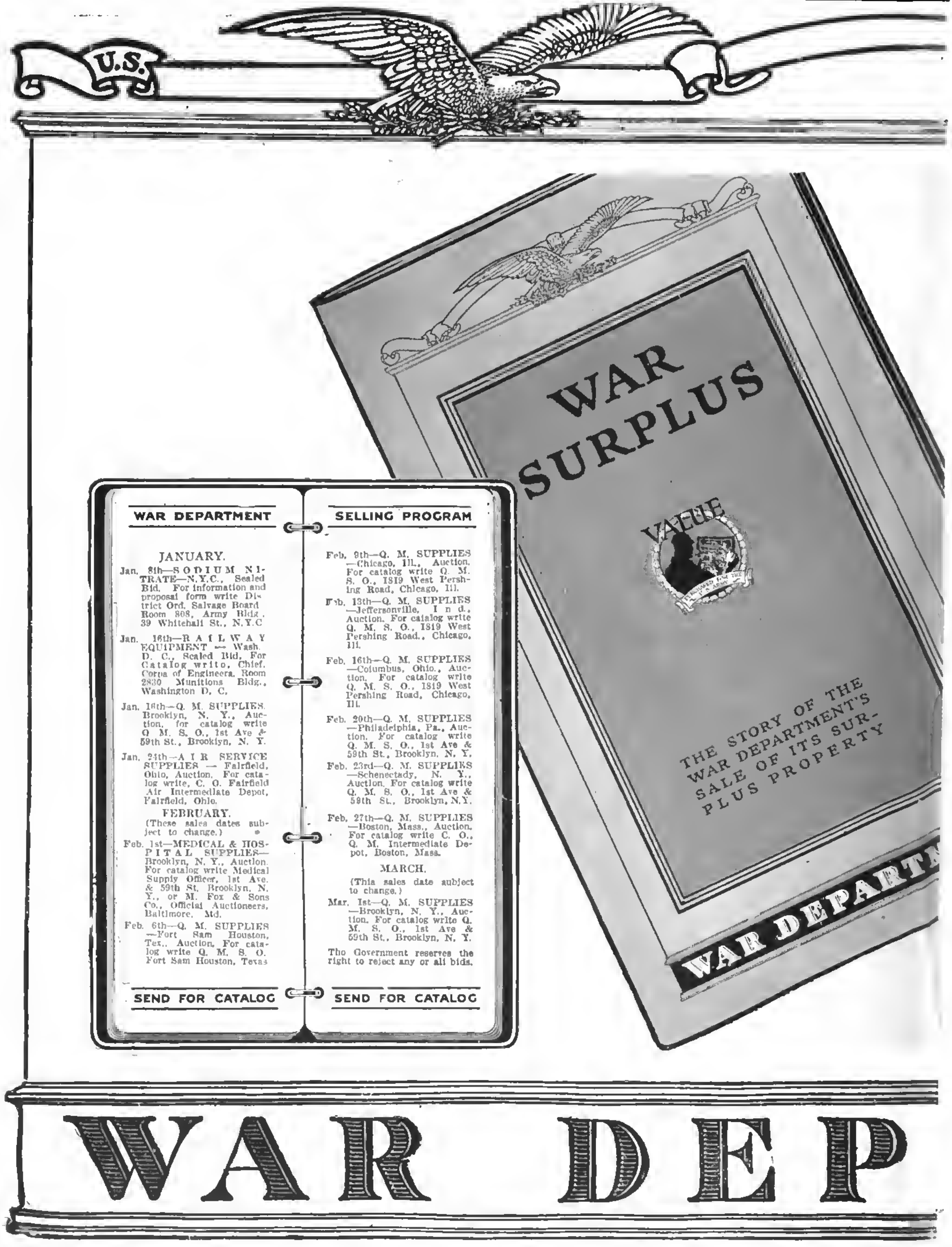

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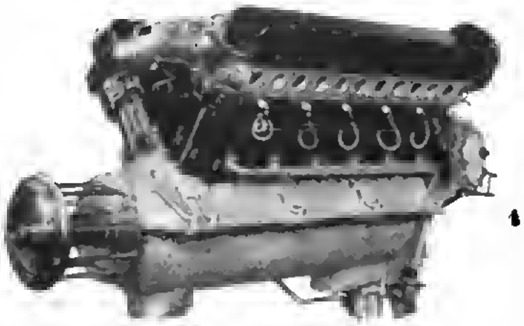

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Aviation and the Feminine Touch

By Otto Praeger

Formerly Assistant Postmaster in Charge of the Air Mail

DOES not the whole development of commerce from the very beginning down to this day of palatial steamers, fast trains, luxurious automobiles, and speeding aircraft owe its genesis to the needs or demands of women? This carrying to and fro of silks, laces, and other choice products of the loom; of rare spices, perfumes, and feathers; of silver, gold, and diamonds and the thousand and one luxuries of the boudoir is inspired by women. Mere man would be satisfied to go fishing, letting everything run by the board except, perhaps, the silver, gold and diamonds.

Moreover, it is the same with foodstuffs and other necessities of life; they go to satisfy the demands of civilization which, in its modes and economics, bears the imprint of woman's imagination and management; and, because women are the same the world over, those things which appear for a period to be only luxuries for the wealthy and those in high places, soon become necessities for the common households of the land—if big sister has it, Cinderella will find a way! That which is good for the queen bee is good for the swarm; so we adopt the feminine whim into the family of virtues and are the gainers thereby.

In pre-historic times, say along about the cave-dwelling period, men dragged their wives around by the hair of their heads. After a time, however, they were obliged, due to the development of the "pug", to carry the women pick-a-back. Increases in the family, and an occasional case of obesity, in spite of the reputed strength of our forebears, made it too much of a hardship to continue this method of transportation, so, in self-defense, men tamed horses. From that time on, of course, the women either rode horseback, or were carried in some kind of cart. In the early stages of cart transportation, springs were unknown, and would be today if the women had been satisfied to bump around at the risk of a broken neck, even on the shortest journeys; but they were not—consequently the paved road and spring-fitted carriage came into existence, followed, in later time, by the railway coach and the ubiquitous automobile.

The automobile, while early promising a pleasant and comfortable method of conveyance, developed rather slowly following its inception, being mainly used by young men of sporting proclivities who dashed recklessly around the country in "red devils" and "yellow flyers". Women, casting a weather eye at this new method of transport, decided that automobiles generally were too greasy, lacked proper upholstery, and exposed the complexion to wind and

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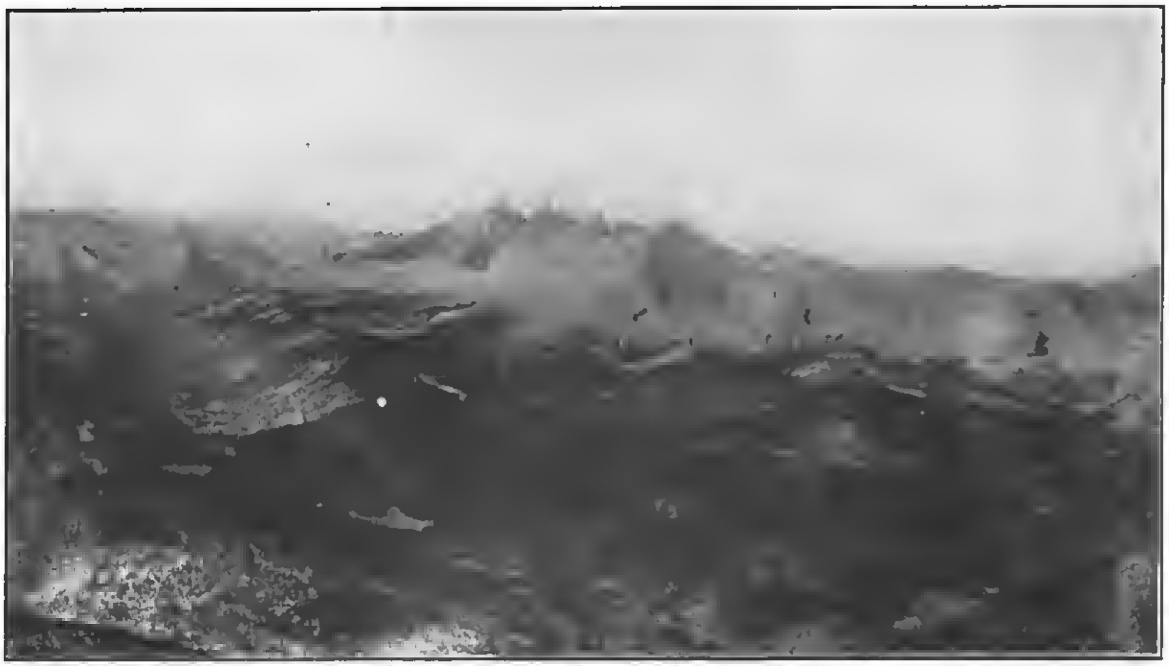

It is silly to think of any other mode of travel except by air, when searching for the intimate details of mountain ranges. Here is Mount Whitney and Seven Lake Region. So much terrain brought under the eye by trailing through the mountain wilderness would consume months of travel; while the region can be minutely studied in a day from the air.

weather in a measure not to be tolerated by any woman who was liable to be called upon any evening, at short notice, to bedeck herself and look her prettiest in order to advance the political or financial interests of her husband at some function arranged for the purpose. One or two manufacturers of automobiles, however, who were either students of feminine psychology, wise beyond their day, or gifted by a kind Providence with more brains than the average manufacturer, brought out the limousine.

This was the dawn of a new era in the automobile industry. Cars with beautiful lines, polished to an amazing degree, luxuriously upholstered with French whipcord or Arabian velour, with cradle-like springs and, in addition, provided in the left-hand inside corner of the tonneau with a cut-glass cornucopia capable of holding a five-dollar bunch of violets, interested the women greatly, whereupon they bought or induced their mates to buy automobiles by the million.

Aircraft manufacturers and operators must take a page from the book of the automobile industry if aircraft is to be made an economic factor in the life of this nation; if the industry is to be established on a grand scale, and if comfort, safety, and reliability are ever to be synonyms of the word, Aviation.

Women have merchandised and socialized the automobile. They will do the same for aircraft. Howbeit, women are not going to be interested in air navigation as long as they are obliged to walk through the mud of an improvised flying field, put on a heavy leather jacket, crush their best front and back hair out of place with a leather helmet, climb into a dinky little "1 x 3" seat, and have their spines nearly dislocated as the plane rushes across the field to take the air. For what do speed and beautiful scenery amount to when a woman's front and back hair is being crushed! The other side of the picture is the solution of the Aviation problem.

Well-turfed and lawn-like flying fields, setting off the beautiful lines of an air cruiser which has a luxuriously upholstered cabin, fitted with crystal observation windows, with comfortable arm chairs, foot rests, mirrors, and a cut-glass cornucopia capable of holding a five-dollar bunch of violets, and in which Milady, without fear of grease or leather helmets, or risk to front and back hair, may wear "nifty" sporting clothes, or an exquisite ball-room gown, spells nothing but *T R I U M P H*. Provide this sort of equipment and aircraft sales will rival those of the automobile.

Miss Jeanette Moffett in flying togs. The father of this charming enthusiast is Admiral William A. Moffett, Chief of the Navy's Bureau of Aeronautics; it appears that militant woman can and will do all her menfolks dare, otherwise we must state that Miss Jeanette is a "chip from the old block".

Proof that women are already influencing commercial aviation is available in the passenger lists of the regularly established air lines in Europe, such as London to Paris, London to Brussels, Paris to Antwerp, and others radiating from European Capitals. The same is true with reference to the passenger list of the largest airboat operating company in the world—right here in America. In fact, an overwhelming proportion of the passengers carried by all these lines, both in the United States and abroad, are women.

In London last summer two women, whose aggregate age was one hundred and seventy-six years, stepped into a cabined air cruiser at Croydon, London's air port, and, a few moments later, were whisked away to Paris. Returning to London next day they gave interviews picturing the delightful experience of flying between the two Capitals, over so much historic territory of such peculiar natural beauty—curiosity wins; age is nothing.

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"The Hub" from the air. Boston—a queer jumble of streets following the proverbial colonial cow-path, is a very interesting city from the air. The Custom House tower dominates the water-front section, and just below the steamboats at East Boston Docks and close to the water-front may be seen the steeple of old North Church, famous in connection with the midnight ride of Paul Revere.

© Official U. S. Army Air Service
The historic "Hub", the Arc de Triomphe, Paris, centered at the Etoile, with the grand avenues radiating to distant vistas. Only from an airplane can this beautiful aspect of the Arc be realized.

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There is something about flying which appeals strongly to women. I presume this is because women are particularly impressionable. Natural beauty generally, and the grandeur of mountain, lake and shore scenery in particular, has an exhilarating effect on the psycho-sensibilities of women. That this should be so is not to be wondered at. For instance; the world is full of Florence Nightingales. The battlefields of the Western Front have absorbed the dust of a great host of soldiers who died in the heat of battle. It has also absorbed the dust of many, many tenderhearted women who, after the excitement of battle was over, stood by and ministered to the wounded and the dying, and helped to bury those whose lives had been snuffed out. It takes the woman to fulfill a mission which requires a refined and chastened spirit and calls for calm courage. So, then, woman's mind quickly attains to the highest sensibilities of the race as we advance toward a complete and perfect civilization.

It holds true in flying. No woman can soar aloft until the great landmarks of the terrain are the only ties to the familiar scenes to which she is accustomed without sensing the immensity of space and the apparent narrow limits of our workaday world. Once high in the blue, her thoughts are released from the confining channels of household economy and the pressure of grinding care. Then it is that the aesthetic and broadening psychic influence imparted by flying grips her and quickens all her senses. That's why women are the most enthusiastic aerial passengers. Given a high type of equipment, with comfortable appointments, and women will do all of their touring by air.

In comparison with train or steamboat, aircraft win on speed alone. It is now a daily occurrence for London women to leave that city at 7.00 in the morning and, by air, arrive at Paris by 9.00. After spending a whole day shopping in that delightful city, or attending the races at Longchamps, Milady boards a returning airplane at 5.00 in the afternoon, and is dressed and ready to take her place as hostess at the usual 8.00 o'clock London dinner. She would have to endure seven and one-half hours of rail bumping and steamer-tossing in the steamboat-train-steamboat method of travel between the two cities. By this latter route, the trip is a two-day undertaking, and requires a third day if one really wishes to see Paris, or enjoy any of its activities.

Add to the convenience the exhilarating atmospheric conditions through which one flies, with rattle and dust and sea-sickness eradicated, with the scenic glories of two of the most historic and beautiful countries in Europe spread out before one's gaze as the plane wings along, and there can be no question about the desirability of touring by air, nor the fact that woman will demand it in greater and greater measure as time goes on.

Now let it be known that we have magnificent scenery in this country, and in such overwhelming measure that it may be reached within one or two hours by air from any of our great urban centers; and, further, remember that Great Britain and France are mere patches in comparison with the enormous extent of the United States. Consequently, in our land there are countless miles of air routes which may be laid out, which will bring a great convenience and, in addition, a great source of pleasure to women engaged in business, incidental shopping, or pure unadulterated touring by air.

It is reasonable to suppose that when aircraft manufacturers incorporate in their designs those features which the good taste and comfort of women demand, the whole industry will be materially benefited thereby, and we may expect a larger demand from the flying public for aircraft suited to passenger traffic.

Commercial aeronautics is gaining in volume from day to day, but the growth is slow. Such growth can be accelerated by giving attention to greater comfort in flying; consequently all future designs should, like that of the automobile, make aircraft particularly attractive to the feminine portion of the flying public which, according to the reports of aircraft operators, now comprises a large majority of all persons utilizing aircraft for travel and for sightseeing.

N. A. C. A. Compressed Air Wind Tunnel

First of Its Kind in the World - Operates in Greatest Compressed-Air Tank Yet Built

THE compressed air wind tunnel of the National Advisory Committee for Aeronautics has been completed and is in operation. On June 9, 1921, the Committee authorized the construction of this unique device, designed by Dr. Max Munk, technical assistant.

In short, the device consists of a 5-foot diameter wind tunnel of known type enclosed within a steel tank 15 feet in diameter and 34 feet long. This cylinder has been tested for an internal pressure of 450 lbs. per square inch, though the average working pressure will be 300 lbs. At one end is a large door, weighing two tons, opening inward. Along one side are glass windows placed at vantage points where may be viewed the recording instruments for the model placed in the test chamber. The interior of the tank is perfectly smooth, there being no interior bracing of any kind. The plates, 2¼ inches thick, are butted together and riveted to outside plates. The whole rests on a foundation of concrete. At the ends and along one side is an elevated platform. Provision is made for setting wing angles from without the cylinder.

The wind tunnel motor is of 300 h. p. and the Reynolds number is controlled by changing the air density rather than by changing the air speed. The air compressing units consist of two 300 h. p. compound compressors which compress the air to 115 lbs. per square inch. The air is compressed into a receiving chamber and then is again compressed by a 175 h. p. duplex booster compressor to the desired 300 lbs. in the test chamber. With these units it requires about one hour to fill the chamber with air at 300 lbs. pressure per square inch. Every provision has been made to avoid opening the chamber until the model is completely tested. Provision is also made to maintain constant density so as to take care of temperature variations.

At the door end of the cylinder is the intake of the tunnel, with a honeycomb structure for straightening out the air as it enters the tunnel. At the other is a suction fan which draws the air through the tunnel at a speed of 90 m. p. h. past the model suspended at a proper point between the two.

At the rear of the fan is a partition

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The N. A. C. A. Compressed Air Wind Tunnel

so designed as to divide and divert the air into a return stream between the walls of the wind tunnel and those of the tank, back to the intake end of the tunnel again.

The speed of the air can be varied to known speeds through altering the r. p. m. of the fan, which is shaft driven through stuffing boxes from the outside of the tank.

Models of a span of 2 feet may be tested, but the results are expected to be strictly comparable to similar data for a full-sized airplane spanning 30 feet in free flight at 100 m. p. h.

The utility of the old type of wind tunnel is limited by the fact that owing to a "scale effect" the results of tests on small models, usually about 1/20th scale, are not immediately applicable to the full-sized machine. Obviously, it is desirable to obtain results strictly proportional to those obtained in free flight. This condition may be realized by the use of a wind tunnel in which the air is compressed to about 20 atmospheres, or more, in order to compensate for the difference in the "scale" or Reynolds number for the model and for the full-sized airplane.

Will Captive Helicopters Replace the Observation Balloon?

Flight of 1 hour with Kármán-Zurovec Machine—Many Advantages Claimed in Artillery Adjustment—A Flying Machine That is Tied Down for Flight.

"WELL, here it is—what good is it," said an aeronautical engineer as he watched the successful flight of the Berliner helicopter this last summer.

"What good is a new born babe," was the retort of an army officer not unfavorably known for his advanced and broad ideas and unquenchable initiative. "It's got to grow and make a place for itself."

The helicopter idea is most as old as the airplane. Some had the idea it could be put to practical use, not only in war but in peace.

What might not be possible in war, say, with a little frame, an armored box for the observer, electric motor and screws, driven up to any desired height through electric current from a portable power plant, and held captive. Might it replace the bulky and comparatively unwieldy kite balloon.

For the helicopter is claimed low perceptibility, smallness of target, non-inflammability, possibility of armament against enemy aircraft, especially good field of fire overhead, especial adaptability to shipboard use, rapid movement of position, a use as masts for radio, for the conduct, unmanned of meteor-logical observations, and as protection of open cities and coasts.

It is claimed by its proponents that it can replace the balloon and effect a saving in personnel. A comparison is made between the personnel for a German balloon company with 1 balloon and that for the helicopter:

Balloon Company
1 auto winch car
2 gas cars
3 auto trucks
6 officers
137 men

Helicopter Unit
1 auto and three trailers
1 auto truck
6 officers
20 men

Getting Clear

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Speculation as to the achievement of actual sustentation is of the past. The Berliner machine actually flies free, successfully. The Kármán-Zurovec machine actually flies captive, successfully.

The Petróczy - Kármán - Zurovec Captive Helicopter

The present renewed interest in the direct-lift machine warrants the recollection of hitherto unpublished information on the machine of Dr. Kármán, which made so many successful flights in 1918, before the conclusion of the war, under official auspices.

The Petróczy-Kármán-Zurovec captive helicopter, which apparently has proved the most successful of all foreign experiments of this character, is the work of Theodor v. Kármán, retired professor of a technical high school at Aachen.

In 1916 Lt.-Col. Stefan von Petróczy, in command of an Austrian instruction balloon company, proposed to the Austrian war ministry the idea of a captive helicopter. Funds were subsequently obtained and experiments started, with the assistance of an engineer, W. Zurovec.

After tests with slow speed propellers, with rubber driven models, and a compressed air engine, two full sized systems were commenced: one with electric power and the other with rotary gasoline engines.

On account of difficulties with the electric motor, this line of work was discontinued, though the machine climbed to a moderate altitude with three persons.

Description of Second Machine

The second project resulted in flights up to 60 minutes. This machine consisted of two co-axial propellers turning in opposite directions, both of 6 m. diameter, operated by 3 captured rotary Gnomes, later replaced by 120 h. p. Rhone engines turning at 1250-1300 r. p. m., driving through a common bevel gear the two shafts, one within the other, which drive the two screws in opposite directions. Gear ratio 1:2.25, so that at full speed the screws turned about 560 r.p.m. The entire power plant and the screws were mounted in a triangular frame of tubing, welded. The three arms were fastened to the central case by bolts for quick disassembly. The three arms carried the fuel tanks which acted as the outer supports of the engines.

In the Air

The whole structure rested on a 1 m. diameter buffer and each of the three arms had a smaller air buffer, with pressure relief valves. It is reported that by this central arrangement and the common gear there is a constant equality in the revolutions of the two screws, so that torque moments about the vertical axis and about the horizontal axis are avoided.

The Petróczy-Kàrmàn-Zurovec Helicopter

The observers' car of veneer was placed above the screws, the car measuring 1.5 m. high by 1.3 m. in diameter, rigidly fastened through the hollow inner shaft to the stationary gearbox. On the edge of the car was a machine gun mount, and inside was the parachute.

The propellers were of wood and had a diameter of 6 m., and a changeable, especially calculated pitch, taking into account the fact that the lower one works in the slipstream of the upper. The ratio, lifting capacity, efficiency in h. p., depends, for the screw, on the "unit load", or the load of the unit of the area circumscribed by the screw tips. With a small unit load a better lifting capacity results, while with a greater unit load a smaller lifting capacity for each h. p. is obtained.

Lift Obtained

For 560 r. p. m. a lift of 5.5 kg. per h. p. was obtained. When the two screws are arranged one above the other, the unit load naturally is increased and the value 5.5 kg. h. p. must be reduced. The constructors found for the finished machine a lifting capacity of 4.5 kg. per h. p., which "value can be increased by increasing the diameter."

The four buffers were filled with compressed air, the central one taking the main weight and the three smaller ones for absorbing side shocks in alighting with one side low. All buffers had pressure relief valves and a verticle drop of 7-8 meters a second could be taken care of without injury to the engines and gear. Ordinary landings were very gentle. A falling speed of 8 m. a second would be reached only in the event of two of the engines being out of commission.

In the observation car a parachute of 250 sq. m. surface was provided, opened mechanically, and it was expected that such a 'chute might be expected to carry the whole machine, including observer, in event of complete failure of power plants. But, it is claimed that two engines alone will let the apparatus down sufficiently gentle, and that even two engines may be out of commission and the buffers will absorb the shock.

Anchorage

Three cables, leading from the 3 arms of the machine, ran over as many pulleys on the ground to 3 winches on one shaft, 70 m. from the machine, the 3 pulleys being at the

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points of an equilateral triangle, varying in dimensions according to the altitude to be flown. From trials it was found a baseline of 200 m. was required for an altitude of 1000 m. though the trials were all made at the relatively low altitude of 20 m. One of the 3 winch drums was keyed to the shaft, while the two others ran lose and had separate power, so that each cable could be shortened or lengthened independent of the two others. These drums measured 0.5 m. diameter and were operated by a 20 h. p. electric motor. A manometer measured the total tension of the 3 cables. By means of the cable arrangement the helicopter could be controlled and steered from below, within limits.

Operation

In starting the ascensions, conducted near Budapest, the engines were cranked the starting of one forcing the others to function. The operator has control of the engines at his seat in the car and the operation of the winches was at his order. In the trials, the machine rose with a velocity of 1.2 m. per sec. The helicopter was drawn down by reversing the winches, while the engines ran at full speed, no experiments having been made with throttling.

Weights

The total weight of the machine, inclusive of power plant and fuel (140 kg.) for one hour without observers, amounted to about 1250-1300 kg. (2750 lbs.). Approximate measurements at 1350 r. p. m. and an estimated efficiency of 390 h. p. gave a lift of 1755 kg., or 4.5 kg. per h. p. It is seen that in flight the helicopter is pulling at all times against the cables.

Flights

Trial flights were made on a number of occasions in the Summer of 1918, the longest lasting 60 minutes. The machine was found to remain stable with wind velocities of 8 m. per sec. The anchorage system was proven satisfactory, for the machine could be controlled and steered in any direction, the principal condition being a sufficient surplus of lift which stresses the cables accordingly.

The excess of lift, measured just above the ground, ran from 150 to 200 kg., according to weather conditions. At an altitude of 40-50 m. the excess lift decreased to 40 to 60 kg. and it often happened that, owing to unequal running of the engines, there was no excess lift. However, when the excess was sufficient to keep all 3 cables taut the machine remained perfectly motionless; on the contrary, if it hovered a few seconds without an excess of lift, the machine commenced to gradually oscillate. These oscillations could be stopped by hauling in on the lines, when the tautened ropes would quiet the machine within 15 or 20 seconds.

In all, more than 30 successful ascents were made, from 1 to 50 m. altitude, hovering sometimes nearly a half hour quite motionless at 50 m., and, by guiding it at the winch, its position horizontally could he shifted in any direction.

McCook Field To Move

THE Government is to accept 5000 acres east of Dayton, including the field where Wilbur and Orville Wright conducted their first flights in the presence of witnesses in 1904, 1905 and subsequently.

Negotiations are being concluded with the Government by the Dayton Air Service Incorporated Committee, a corporation, which had charge of the campaign in which more than $400,000 was raised for the acquirement of the property. After paying for the land it is expected there will remain about $100,000 as a nucleus for a fund for a monument to the Wrights.

The land is 1½ miles east of the city limits, extending from the village of Riverside to and including Wilbur Wright Field, comprising about 4325 acres. The tract is the gift of the city of Dayton under the condition that it revert to the city in the future event that it is abandoned as a flying field site.

Dayton publicity announces that the Air Service plans an expenditure of $10,000,000 in buildings and equipment.

The site of the present experimental station of the Army Air Service engineering division belongs to the General Motors Co. and it is impossible to obtain a sufficiently long lease to warrant further tenantcy, the new site being selected from among numerous offers from other cities.

McCook Field now has the second largest payroll in Dayton, which means an annual payment of $2,000,000 to $5,000,000. Dayton also receives continuous worldwide publicity, from the Government aircraft experiments, employment is given from 3000 to 5000 skilled men, building of new homes is aided, the populations increased as well as that of the retail merchants, and it is expected that aircraft manufacturers and visitors will be drawn to Dayton through the permanent location of this station.

New Orleans—Pilot Town Air Mail

THE following data has been received from the New Orleans Association of Commerce with regard to the proposed Air Mail Service between New Orleans and Pilot Town.

The Service was proposed by the New Orleans Postmaster with the enthusiastic support of the Postal Facilities Committee of the Traffic and Transportation Bureau of the New Orleans Association of Commerce.

New Orleans has an airplane landing field located at the old city park race track now owned and controlled by the city of New Orleans. There are no hangars on it. Its location is slightly north-west of the foot of Canal Street, about four or five miles from the point where mail is to be taken on for Pilot Town. There is another field in the upper section of the city, commonly known as the Peters Avenue Airplane Landing Field, which was used during the American Legion Convention by sixteen airplanes. There are no hangars on it, and the owner is unwilling to give a long lease.

In the opinion of the New Orleans Association of Commerce, land planes are useless for the proposed service to Pilot Town, the reason being that the fields in New Orleans are too far distant from the mail terminal and that at Pilot Town no land facilities exist, the town itself being built on stilts driven into marshy soil.

Hydro-airplanes are absolutely necessary. In New Orleans hydro-airplanes can make a landing conveniently in the river, both at the foot of Canal Street where the river is ¾ miles wide, and at Pilot Town, where the river is 1¼ mile wide.

The airplane operator taking the Air Mail contract would not also be obligated for the transportation of the mail from the New Orleans Post Office to the air terminal, this being a separate contract under the local Postmaster.

It is regarded by the New Orleans Association of Commerce as necessary for the operator to have a motor boat at Pilot Town, in which to handle the mail to the steamers from the plane. It is possible that a satisfactory arrangement could be made with the Pilots' Association, whereby mail would be transferred in the same motor boat used by the pilots in transferring from incoming and outgoing ships to the wharf at Pilot Town.

There are 91 steamship lines entering the port of New Orleans, which the Association of Commerce believes would give the airplane operator an average of at least 300 lbs. of first class mail each trip.

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This flock of Navy carrier pigeons, circling about the "wireless" mast at the Naval Air Station Anacostia, Washington, are all trained messengers, some of them have won world's records. The revival of the breeding of such birds in America is directly due to the demands of aviation.

Aviation Pays Its Way

By Conway W. Cooke

National Aeronautic Association of U. S. A.

NOTHING wears out its welcome so quickly as an institution which "feeds" from the public treasury without showing tangible and immediate returns. It is the misfortune of certain governmental bureaus to be forever engaged in experimentation and research—thus always in need of money, and fated to have their work buried under official blankets; while those bureaus whose activities are rated as "confidential" and "secret", much of their efforts never uncovered to public view, are "anathema" and thornlike to Congress. This last is the case of military and naval aviation—Congress doesn't like them; prohably never will.

Yet those two air services, notwithstanding their problems of extensive investigation, and the fact that a considerable portion of their appropriations are spent on problems involving the greatest secrecy, this secrecy for obvious military reasons—really repay the nation many fold for every penny used. Those very research experiments which seem so wasteful to the uninitiated are the things that pay the most. For nothing is lost; the mysteries of chemistry, of metallurgy, the queer behavior of metals under heat, the mechanical processes of the laboratory, and the salvage of seemingly unimportant hy-products resulting from the solving of definite problems placed before our aeronautical engineers, are turned over to our industries for the benefit of the nation at large.

Duralumin, an aluminum alloy with the weight of aluminum and the strength of tensile steel, one of the most important metals in industry, has just been put on the industrial market as a result of the Navy's efforts to build airships of the rigid type and equip itself with all-metal airplanes. Four years ago duralumin had never been produced in this country. It was a product of German ingenuity, and its development in that country made possible the building of the huge Zeppelins which proved to be such a pest to England and the British fleet. If we were to have all-metal planes and rigid airships, we must needs produce duralumin. The German secrets were too well guarded to become our property. Analyses gave us the composition of the alloy, but the heat treatment process we could not fathom.

However, the Navy placed contracts for duralumin with private concerns, awarding them on specifications which were deemed to be the basis of success. At the same time the Navy undertook experiments of its own, and the combined effort brought forth a type of duralumin of greater tensile strength than the German product. With this metal the Navy is now building the rigid airship ZR-1, under construction and assembly at the Naval Aircraft Factory at Philadelphia and the Naval Air Station at Lakehurst, New Jersey. In addition, both the Army and Navy are contracting for American-

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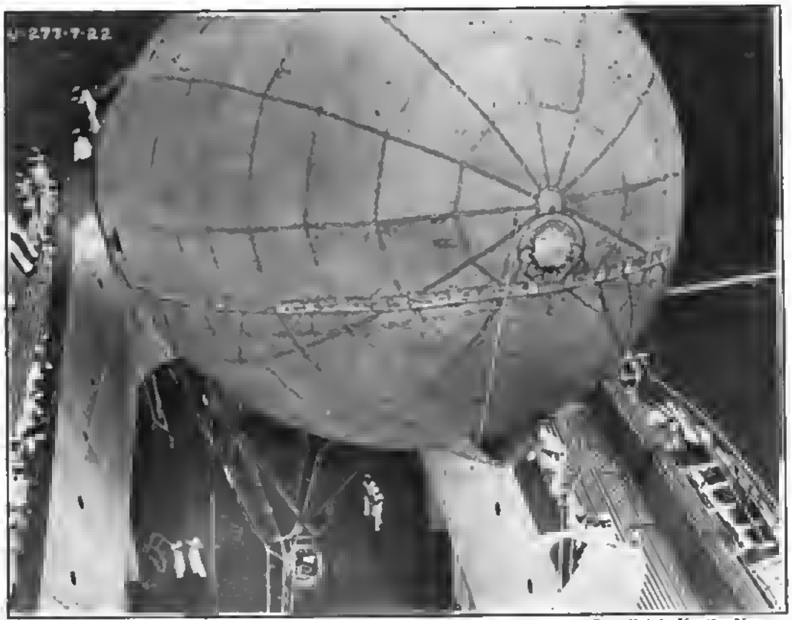
built all-metal planes of duralumin; while the aeronautical industry of the country is revelling in all-metal planes of American duralumin. What this new metal means to the manufacturing fraternity throughout the Nation cannot be estimated in dollars and cents. Here is one governmental problem, the solving of which has paid for many expensive experiments.

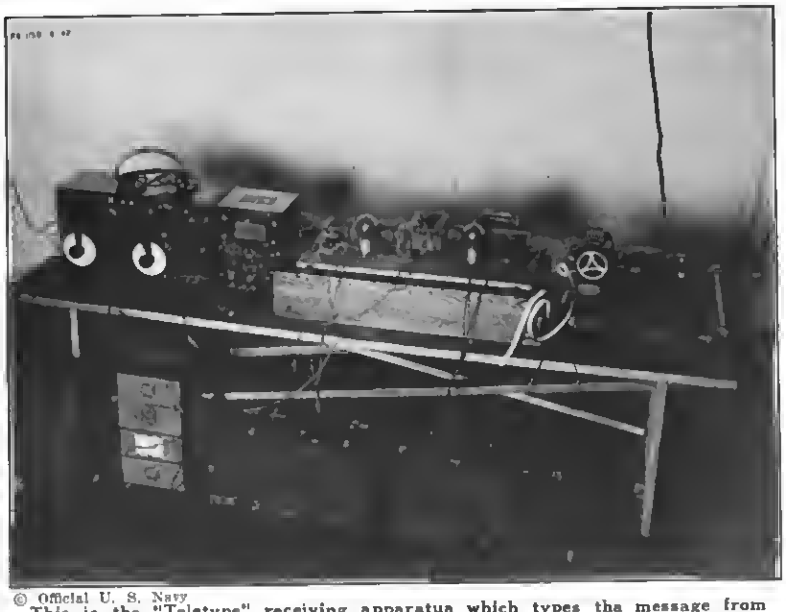
In their efforts to improve the motive power of aircraft, the aeronautical engineers of the Army and Navy have benefited the whole internal combustion engine industry, together with the fuel and lubricating industries so closely allied therewith. Aircraft engines are high-speed power plants; they are called upon for extreme speed under adverse conditions, yet they are the lightest in weight for actual horse power produced of any type of engine in practical use. Strength of materials, heat resisting alloys, lubricants of unusual viscosity, fuels of the most efficient character—all to be used in combination to give a power plant of the utmost flexibility and performance, came into the problem of aircraft design and experimentation.



© Official U. S. Navy
The perfection of balloon fabrics have had a direct influence on the price and quality of your own raincoat. A Navy kite balloon is here shown being housed in the balloon hold of the aviation mothership Wright.

How well the engineers succeeded in their chase for the ultimate may be gathered from the fact that our Army Air Service holds the world's records for endurance, altitude, speed, and long-distance nonstop flight. Seven miles above the ground; a day and a half in the air without stopping; a speed of four miles a minute; and 2060 miles without a stop are the records. They would be impossible without the most efficient engines ever built.

What has all this got to do with the nation at large? Much. Aside from placing the United States in the position of world leadership in the aeronautical field, the improvements in aviation power plants have been incorporated into the automobile industry, resulting in motors of greater flexibility in operation, with longer life, less affected by heat, more readily overhauled and, better yet, less expensive to build and maintain. In fact, all types of internal combustion engines have followed along with the developments in aviation engines; this means the saving of millions to the public at large, and the reduction of appropriations for the upkeep of governmental equipment depending on such engines for motive power or stationary use. Whatever the Army and Navy has spent for the development of aircraft engines can be no more than a pittance in comparison to the economic returns.



© Official U. S. Navy
This is the "Teletype" receiving apparatus which types the message from a seaplane as fast as the sender can operate his equipment. This is only one of many developments of tremendous value to the radio communication service which is directly due to the solving of a problem in air navigation.

In the development of flying boats and other naval aircraft, many products have been newly invented, while others have been so improved that their use has been multiplied many times over. This is true of marine glues and varnishes, for not only have these products been made impervious to water, but heat and friction resisting to an astounding degree. These improvements are already reacting on the refinement of motor boats and yachts, automobiles, railway coaches, and outdoor furniture. Even the search for high-grade balloon cloth and the manufacture of aviators' clothing has influenced the production of waterproof clothing and fabrics impregnated with rubber for a thousand uses. Thus, aviation has brought about economic changes in the rubber-cloth industry, in the cotton duck industry, and in the silk industry. Because of aviation's necessity, your raincoat is a better garment and costs you less than the unimproved type of a few years ago.

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In the rush of aircraft building by the wholesale, many furniture-making establishments and piano factories were taken over *en toto,* by contract, by the Aircraft Procurement Board. These manufactories naturally continued their old processes in veneering, dowelling, turning, and laminating. It soon developed, however, that the extreme speed of airplanes and seaplanes, together with the continued exposure to damp air and seawater, demanded something more rigid and substantial than the accustomed methods of these manufactories could produce. In the end, new methods of wood curing, new types of turning machinery permitting the mechanical shaping of struts, propellers, and wing braces; improved laminating processes; and more scientific selection of veneer woods, succeeded the older practices. These improvements have been retained by the industry and are incorporated into the manufacture of articles wholly or partly made of wood. While the woodworking industry has not been revolutionized by the influence of aviation, it has been materially affected, and for the better.

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Women have taken their place in the aeronautical industry. These women are working on the fabrication of balloon cloth at the Naval Aircraft Factory at Philadelphia.

Perhaps one of the queerest developments of aviation having an effect on the sports, rather than the industries, is that of the Pigeon Service connected with the naval air force. Homing carrier pigeons have been bred and used for thousands of years; in this country they have been bred and raced by fanciers since early days. It remained for the Navy to rejuvenate this "sport" and make the breeding of "racers" a very profitable undertaking.

In the early days of the War, when equipment was under experimentation, naval aircraft were not the reliable machines they are today. Sometimes a landing had to be made at sea. Then, too, radio communication was not the well-developed service we know today; hence, some means of communicating with shore stations or ships from stranded or drifting planes other than electrical or visual had to be provided. The answer was: carrier pigeons. The problem was solved by enrolling, as Chief Pigeon Officer, Lieutenant James J. McAtee, a breeder of homing carrier pigeons at Pittsburgh and the foremost authority on pigeons in America. By securing the best strains of domestic birds and crossing them with the best from foreign sources, Lieutenant McAtee has produced the most wonderful racers in the world. Even the very youngest Navy birds have won from old experienced racers in practically every contest in which the Navy has entered.

No naval aircraft are allowed to take the air unless two or more pigeons are carried as emergency passengers. Many a naval aviator is alive today because of these little birds, and thousands of dollars worth of equipment now in use would have been utterly destroyed and sunk had the carrier pigeons been wanting. "Down at sea" with radio out of commission, especially in a storm or in a tideway at night, is a very serious affair. Then, a seaplane's crew have no other means of giving their whereabouts except by winged messenger; to the Navy, such birds are worth a king's ransom; due to the Navy, their breeding has been re-established as a paying industry.

One of the most important phases of aeronautical development which has had an immense effect on the electrical industry is the constant effort to improve radio communication while flying. Money appropriated for military and naval research and experimentation along these lines is like the proverbial "bread cast upon the waters"; the returns are incalculable—the whole world benefits by the results obtained.

It is not difficult for the novice to understand the absolute necessity for a rapid and reliable means of communication between planes in the air and their ships and stations, or that planes must talk to each other *by* some means. Only by such communication can aircraft be tactically used in warfare. We must know what the pilot and observer see; we must tell them what we want done next; they must be controlled like any other element of our command. In the Navy, aircraft are the eyes, ears, and tentacles of the fleet—they must be connected to the fleet at all times by a "nerve"—in this day and age, the

(Concluded on page 23)

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All-metal torpedo plane designed for the Navy by Mr. A. H. G. Fokker the celebrated aeronautical engineer who produced the Fokker planes so much used by Germany during the War. In order to provide metal for such planes as this, duraluminum was added to the useful metals in our industry.

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Maintenance and Operating Equipment of Airplane and Seaplane Stations

Types of Equipment for the General Maintenance of Stations, for their Operation and for the Servicing of Aircraft, with some Approximate Costs.

By Archibald Black
Consulting Engineer, Garden City, N. Y.

General Classes of Equipment

The equipment required at airplane landing fields and seaplane stations will vary greatly according to the use of these. Military and Naval stations present special needs which are not in any way comparable with those of civil stations. Such equipment must do more than provide for immediate needs, it must be sufficient to permit very rapid expansion in event of outbreak of hostilities. As a consequence, the average Army field or Naval air station is very completely equipped while most civil stations are limited to the barest necessities. The greatest potential development being along civil rather than along military lines, this dicussion is confined largely to the equipment of civil stations. No matter whether these stations are municipally or privately operated, the equipment will be substantially the same. Leaving aside the questions of buildings and of repair equipment, as outside the scope of this article, the equipment may be divided into the three general classes:

1. Maintenance and general.
2. Servicing.
3. Operating.

A detailed list of the equipment falling within each of these classes is given in Tables 1, 2 and 3. These tables are very complete and include probably every item excepting the small tools required. Indeed, the complete lists contain many items which may not be found at some very completely equipped stations. The tables are not intended as lists of the equipment necessary at *every* station; items would necessarily be selected in accordance with the special needs of the one being considered. No attempt has been made to arrange the lists with items in any order of their importance as this varies so greatly with each case. However, those arranging the purchase of equipment should have little difficulty in using the tables as guides to compile a list of equipment suited to their particular needs and to the funds available. While the costs given in the tables are, necessarily, approximate, they are sufficiently close for use in balancing need against price and in compiling preliminary estimates.

Most Stations Under-equipped

It has been quite customary to operate stations with very little equipment in most cases to date, the lack of funds making initial investment of more importance than operating efficiency. As the use of these stations grows, the poor efficiency, due to this lack of equipment, may be expected to become more felt. At the same time, the increasing use of the stations which causes this will also tend to make additional funds available for purchase of necessary items. We may therefore expect to see the market for air station equipment develop gradually in the near future in about the same manner as the market for garage equipment developed in the past decade. Few civil stations and only a limited number of those operated by the Army and Navy can boast of lists of equipment comparable with those given in the tables. Nevertheless each item is more or less necessary according to the extent to which the station is used. Insufficient funds is generally the chief reason for meagre equipment.

General Station Equipment

The list of station maintenance and general equipment contains no specially designed items. In each case apparatus already on the market is available which is suited to the purpose. A complete equipment of hand fire extinguishers should always be furnished and, where the development justifies, fire engines should also be provided. In purchasing fire equipment particular care should be used to select that suitable for the purpose. Most extinguishers on the market are almost useless for extinguishing gasoline and oil fires, a hazard always present at all air stations, while each type of fire apparatus is particularly suited to certain purposes. The fire alarm need not be an expensive automatic system as any conveniently available, manually operated, gong or bell is sufficient to call all hands together in case of an outbreak. The electric power and light unit will not be required in any case where the electric power can be obtained from outside sources. Where not available, any reliable farm lighting set can be used, the capacity being governed by the area of the buildings to be lighted, etc. The tractor, grass cutter, road drag, and other field and road maintenance equipment included in the list are not often found at stations. Their purchase is however, very desirable as the surface of the field, roadways, runways, etc., can be maintained by the station laborers at very little cost if such equipment is on hand. A very small amount of rebuilding or new construction work is sufficient to cover their cost and, once purchased, there is less danger of the roads and runways being neglected. The light truck included in this list is intended to be used not only for transportation of materials but also for carrying the staff to and from the station as well as for emergency work.

Gasoline, Oil and Water Equipment

Gasoline and oil storage and water supply constitute the first essentials at any station. The safest, most economical and most generally satisfactory method of storing gasoline and oil is in underground tanks which are furnished with measuring pumps. In most cases available funds will not permit the installation of such tanks for both and, in some cases will not permit it for either. Where the under ground tanks are used, any of the approved makes of tanks and pumps now on the market may be used. The tanks should not be located under any of the buildings, roads, runways, etc., and the filler pipe and vent should be located some distance (say, 50 to 100 feet) away from buildings. The pump should be provided with means for locking it to prevent pilfering and it should be of the measuring type. Where gasoline is stored in underground tanks and oil in the original barrels, a satisfactory method is to locate the oil barrels and the gasoline pump in a small outhouse. Where the underground tanks are to be installed it is not advisable to provide tanks of less than 550 gallons capacity as the saving by using smaller tanks is barely

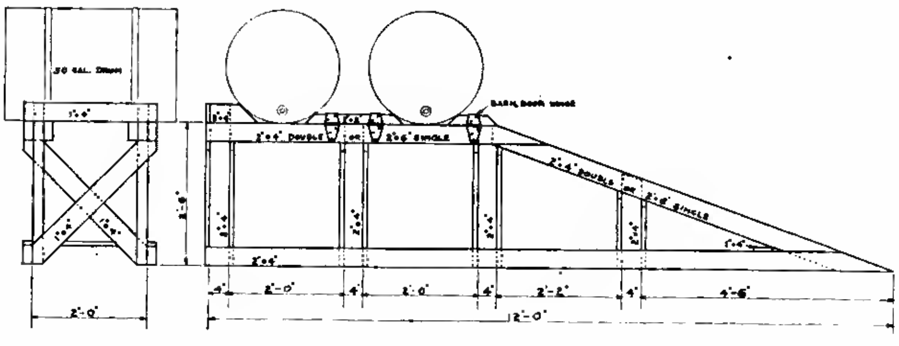

Fig. 1—Oil and gasoline barrel rack.

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worth while. The complete installation of gasoline storage systems of this capacity, including tank, filler, a high grade measuring pump, strainer, pipes, etc., can be made for around $310.00, while the system of half this capacity would only cost about $50.00 less. A cheaper type of pump, with some of the improvements and accessories eliminated, but with the same capacity of tank (550 gallons) can be installed complete for about $200.00 to $225.00. Underground storage systems of one tank car capacity (10,500 gallons) including tank, measuring pump, etc., can be installed complete for about $900.00.

If either the oil or gasoline and oil are to be kept in their original barrels, a rack should be constructed for them to facilitate emptying. Such racks may be constructed of any lumber conveniently available at the station and should provide for one full and one partly empty barrel of each liquid. Unless a track for chain tackle is to be installed over the rack, skids or inclined ways should be provided to facilitate the work of placing barrels on the rack. Figure 1 shows a very simple and suitable rack of this type which is provided with inclined ways up which the barrels may be rolled manually. All oil or gasoline used inside of the hangar or shop buildings should be kept in either portable safety cans or portable tanks of an approved type. Figure 2 shows a suitable type of small safety gasoline can which is available on the market. In arranging provision for the storage of gasoline and oil it is advisable to provide for about 12 to 14 times as much gasoline (by volume) as oil. While this is approximately the relative consumption, the storage capacities will also be affected by other considerations such as those of purchasing.

Fig. 2—5-gallon safety gasoline or oil can. (McNutt)

As to the matter of water supply, where some outside source happens to be available this becomes simply a matter of extending the pipes into the station buildings. In many cases, however, such sources will not be available and it will be necessary to either drive wells where underground water exists or to truck it where not. In either of these latter cases a water storage tank should be provided and protected against freezing.

Oil and Water Heaters

Oil and water heaters are very necessary items of equipment at all stations in northern localities where flying is to be continued through the winter. Not only is difficulty to be experienced in starting airplane engines with cold water and oil in cold weather, but there is also a danger of the water freezing in the engine before it can be started. In cases where very little flying is to be done in cold weather, it will be found sufficient to arrange a heating system by using a small water-back kitchen range, or small water boiler, with the connections coupled to circulate the water through an open top barrel. The water can be drawn from this barrel through a faucet at the bottom while the oil can be heated by placing a 5-gallon can of it inside of the barrel, care being taken to keep the top of the oil can above the water level. A system of this kind can be installed complete, including all material and labor, for $40.00 to $70.00 depending upon how much of the material happens to be already on hand. This outfit is not convenient to use and it is much more satisfactory to install a properly designed heating system where possible. Such complete systems can be arranged quite economically, by using a small water boiler and two cisterns of the type ordinarily used in connection with the hot water systems in small buildings, as shown in Figure 3. An installation of this type will cost about $200.00 to $225.00 to install complete. As any water and oil heating system can be counted upon to heat a small room in which located, it will often be possible to make this the only heating system at the station.

Wheel Chocks and Handling Dolly

In regard to equipment for handling airplanes on the field, wheel chocks and a small truck or "dolly" for carrying the tail skid are very necessary. The chocks are used under the airplane wheels to prevent it from moving while the engine is being warmed up, while the "dolly" is

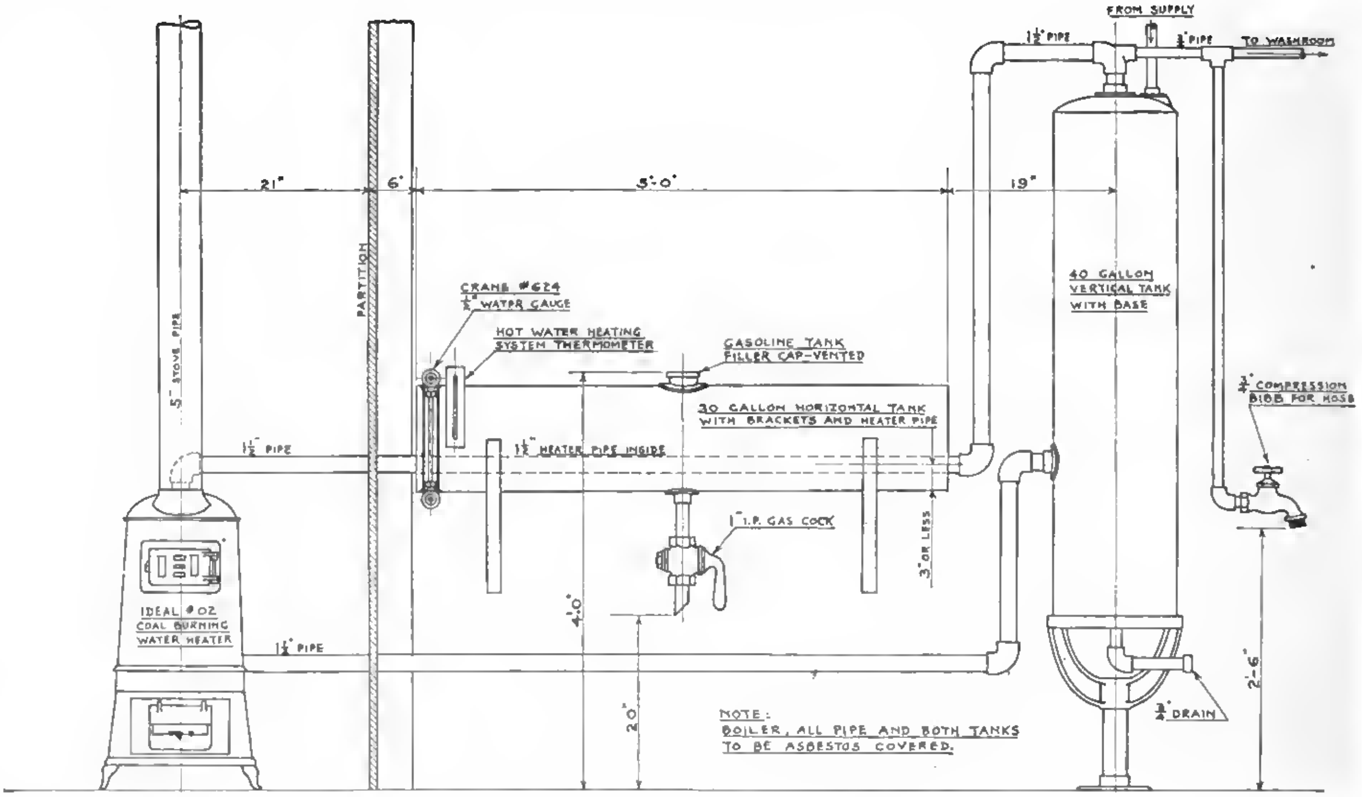

Fig. 3—Oil and water heating system.

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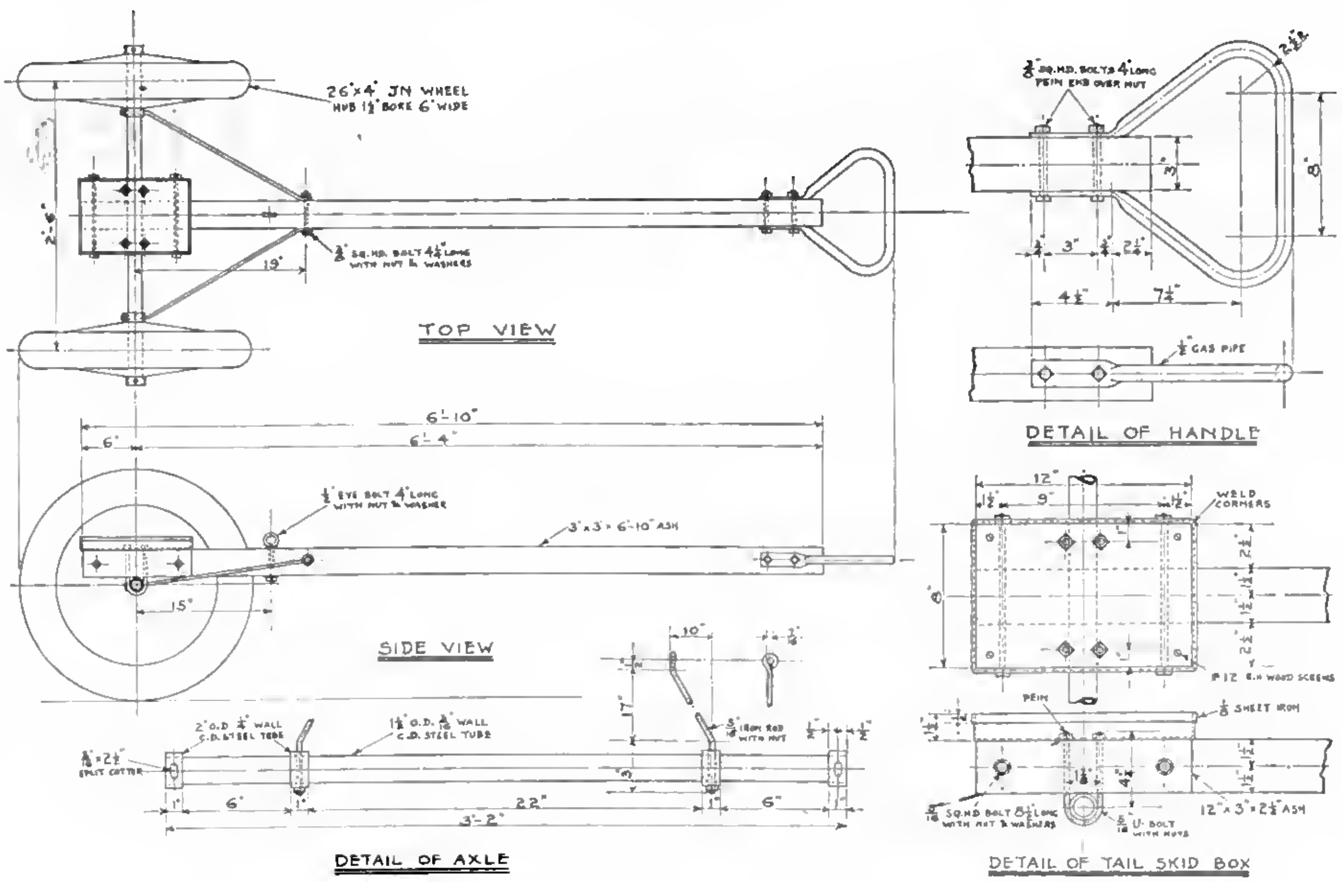

Fig. 4—Tail skid towing and handling dolly

used to carry the tail skid of the machine while it is being moved manually on the field or into and out of the hangar. The wheel chocks can easily be made by the station mechanics from any lumber which may be handy, while the "dolly" can often be also improvised from any old wheels, axle and lumber which may be available. Figure 4 shows a type of "dolly" which can be used for practically any land airplane and which is built of parts usually available at stations. Figure 5 shows a type of wheel chock which can be similarly constructed and is suitable for use with any size of wheel excepting, possibly, the very large bombing airplane ones.

Beaching Runway and Boat Trucks

If only equipment for water types of machines is being considered the wheel chocks and "dolly" will not be required. Instead, a beaching runway or track will be necessary and also one specially designed handling truck for each flying boat or seaplane. The runway or tracks should extend from the hangar entrance, down the beach, to below low water level so that machines may be launched or taken out of the water without regard to the position of the tide. Runways may be constructed by driving piles into the sand, laying over these beams on edge and planking the beams with two layers of stout rough lumber at an angle to each other. Both thicknesses may be laid on the bias, in opposite directions, or either may be laid on the bias and the other across the runway. The planking should never be run *parallel* to the runway. If a track is to be used instead of the runway, it may be constructed like the ordinary marine railway. The width of the runways will depend largely upon local considerations. If on a level with the beach for their entire length, they may be made only a few feet wider than the tread of the truck wheels or, say, 6 to 10 feet, depending upon the size of the boats. In cases where the runway is appreciably above the level of the beach it is advisable to widen it sufficiently to enable the men guiding the wings of the machine to walk on it. As regards the width of tracks for railways, there is no particular reason for departing from the standard railway gauge of 4'-8½" (measured *between* the heads of the rails, not from center to center).

The handling trucks are, of course, provided with flat or flanged wheels according to whether a runway or track is used. In some cases, the handling truck is formed like a cradle to fit the hull while, in other cases, a separate cradle is used and is carried on the truck. Figure 6 shows a typical handling truck for flying boats, in which the cradle is built integral with it. This is generally the most convenient type to use.

Mooring and Hauling Equipment

No special comment regarding the mooring buoys appears necessary as the aver-

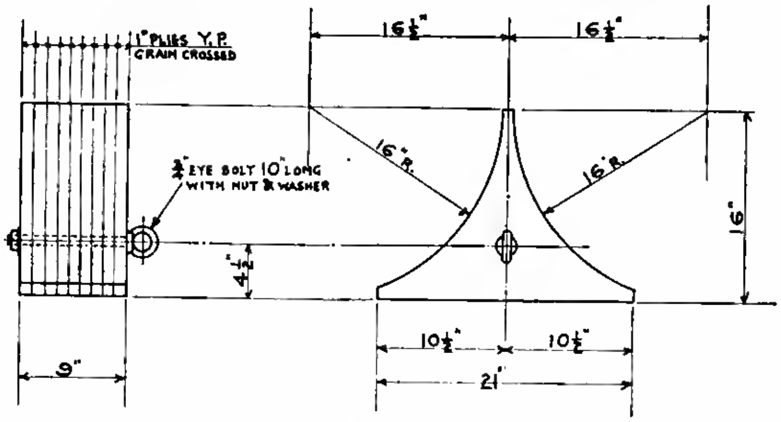

Fig. 5. Wheel chock.

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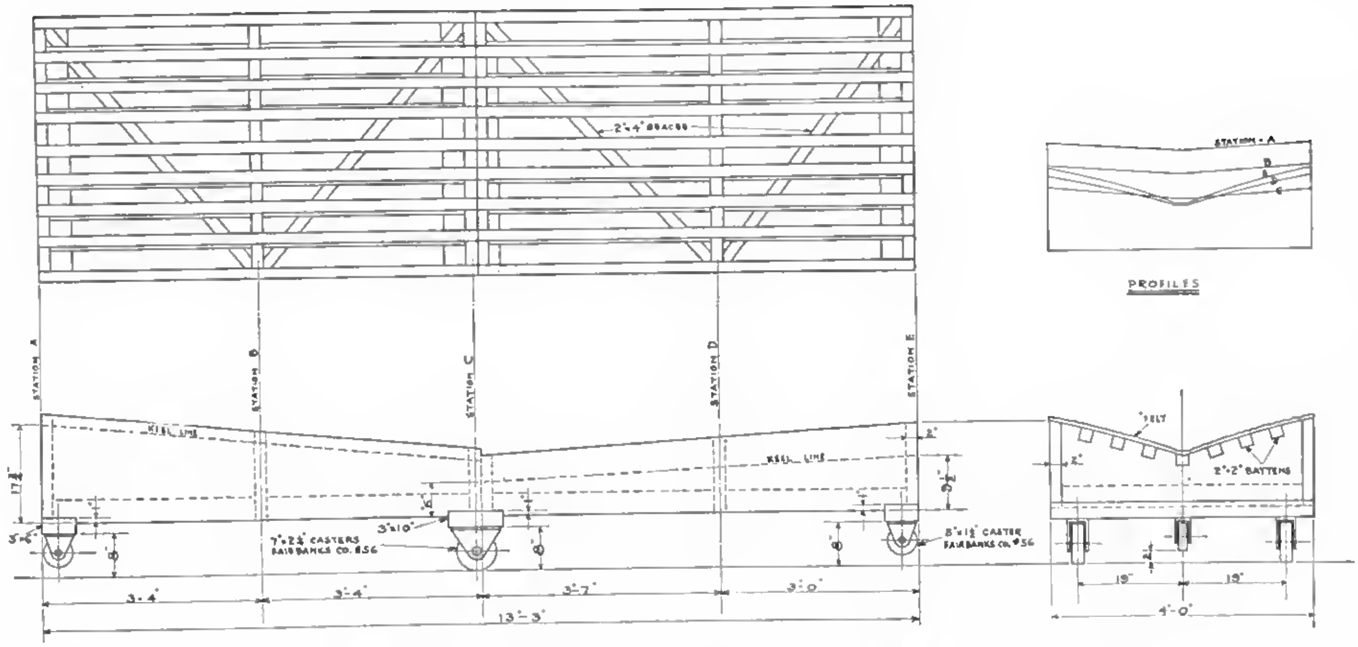

Fig. 6—Flying Boat (HS-2-L) handling truck for hard surfaced runways.

age buoy which is used for power boat mooring is equally suitable for flying boat or seaplane use. Some provision, such as a crab, capstain, crawler tractor, etc., for facilitating the work of hauling out, should be provided unless the beach is quite flat and the boats are small. The crab or capstain represent the lowest initial cost but requires more labor in service than does the tractor. Consequently, tractors should be provided in cases where considerable hauling is to be done. In other cases a crab is probably the most satisfactory. Crabs suitable for this work can be purchased locally or from some firm such as the Sasgen Derrick Company of Chicago, for $68.00 to $128.00 according to their capacity. Small winches, suitable for hauling out the smaller sizes of boats, can be purchased for $20.00 to $25.00. These figures do not include the cost of installation which could, however, be included in the runway or track construction cost without affecting it. Runway and track costs will vary so greatly that there appears to be no way of giving any general cost estimate.

Engine Starters

The portable engine starter is an item which can be omitted until these are further developed and funds for their purchase plentiful. Numerous devices have been used up to date, more in Europe than in this country, but the most of these were built experimentally and not marketed. One simple device which is on the market in Europe, the Odier starter, appears to perform well, although it has the disadvantage of placing the operator in a position where he would be liable to serious injury in event of the wheel chocks slipping. This starter, illustrated in Figure 7, uses compressed air, can be arranged to fit any propeller hub, and is convenient to move around. Many of the other starters built consisted of motor trucks carrying a shaft, driven by the engine, which could be connected to the airplane propeller hub. The English Airco motor power starter is of this type.

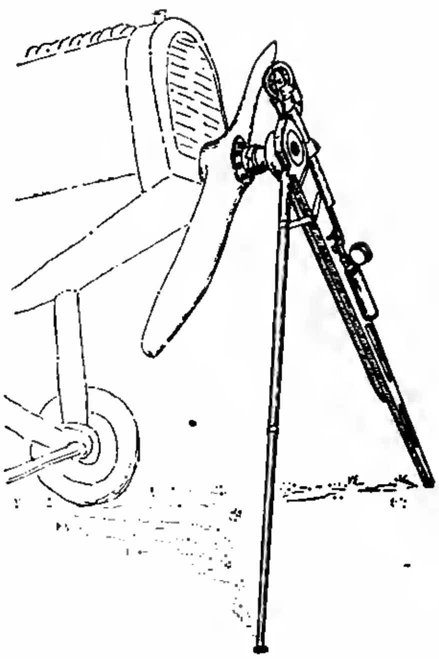

Fig. 7—Odier Portable Engine Starter

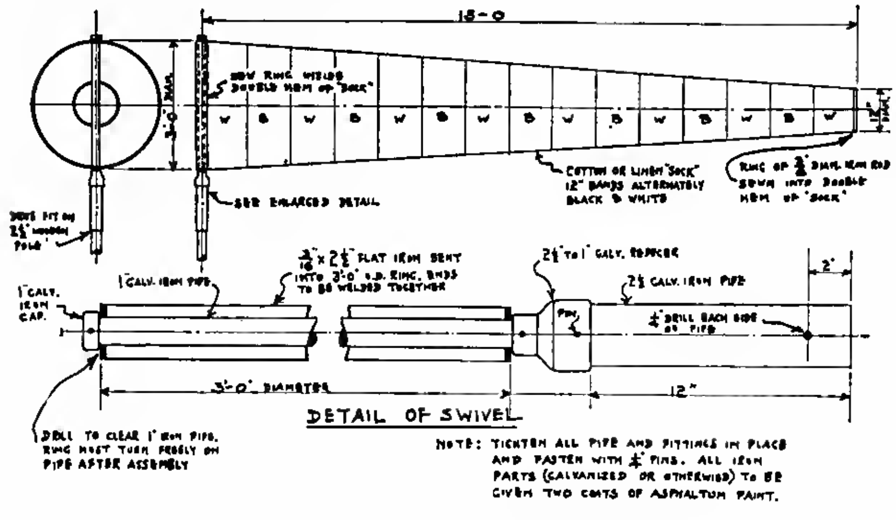

Fig. 8—Wind cone.

Meteorological Apparatus

The wind direction indicator is an absolutely essential item of equipment. Originally a pennant was used for this purpose but it has since been displaced by the wind cone, better known in station parlance as the "sock". In some parts of Europe automatic wind Tees have been developed and are in everyday use but only a few experimental Tees of this type have been huilt here. For a time, the practice was tried at many fields of laying out a white cloth Tee on the surface of the field. This Tee was moved by the station force as the wind changed. The method proved to be somewhat of an abortion and its use has been generally discontinued on account of its obvious disadvantages. The wind cone may be regarded as a very satisfactory device as it is

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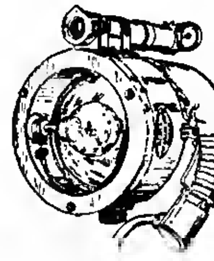

FIG. 9—Aldis Landing Signalling Lamp

economical, automatic, practically infallible, shows every little variation of wind direction and gives the pilot some indication of wind velocity by the angle at which it floats from the mast. A wind cone which can easily be constructed by either the station force or some local shop, is shown in Figure 8. This cone was designed by A. & D. R. Black, based upon an Air Service standard, rearranged to permit the use of ordinary gas pipe and fittings, instead of special parts, in its construction. The "sock" was also changed from plain white or red to alternate bands of black and white to increase its visibility. While shown 15 feet long, the same length as the original Air Service cone, the writer is inclined to regard this as rather long and considers 10 to 12 feet as sufficient. This type of wind cone, as will be noted, is so designed that it cannot wrap itself around the mast and remain in that position for more than a moment, if at all.

Traffic Control Equipment

In cases of stations which are expected to become the scene of great activity, it is advisable to furnish some type of tower or covered platform for the traffic controller to direct the taking off and landing from. This practice has been found necessary at some of the very busy European fields and may be expected to become necessary at stations here in the near future. The equipment suitable for this directing is yet in the development stage, but a megaphone and signal flags may be regarded as essentials no matter what other equipment may be later developed. Experimental installations of signalling lights and radio are now being tried out at some of the European fields. The megaphone should be large and it is advisable to provide both a hand type and a very large swivel mounted one. No standards for the signal flags have yet been developed in this country. The Aldis landing signalling light, an English development, which is shown in Figure 9, is used for signalling between the ground and aircraft desiring to land. This device consists of a 100 candlepower electric bulb, inside of a projector with high power mirror, and with a sight for directing the rays. It is held in the hand and the light flashed by means of a trigger grip switch. The Aldis light is sufficiently powerful to be used for day as well as night signalling.

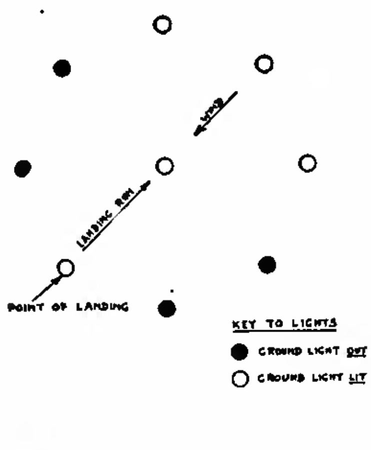

FIG. 11—Pintsch Landing Ground—Light System

Night Flying Equipment

If any night flying is to be done at the station, some special equipment for this purpose will be required. A battery of powerful portable floodlights and a supply of small flares, such as those used in railroad operation, should be provided and all obstacles in or around the station should be rendered visible at night. Although not entirely satisfactory, the best method yet developed of rendering obstacles visible is that of marking their outlines with small lights. Particular care must be taken that all lights, no matter where they may be, are arranged so that they do not dazzle the pilot who makes a landing at night. The floodlights should be placed so that their beams are directed into the wind, the first of the battery lighting the exact spot where the pilot is to touch the ground, while the others illuminate the course which his machine is to take while rolling along the surface after landing. The battery should be placed with the lights close together, and to one side of the path of the airplane, in order to reduce the danger of colliding with them. Figure 10 shows a type of light suitable for this purpose and also the manner in which the battery should be arranged. At least four lights, and preferably six or more, should be provided. In arranging them it should be noted that the important points are to, first, illuminate the spot on which the pilot should set down the wheels and, second, indicate the direction in which the landing should be made. A more elaborate system than that just described is now in operation at some European fields and is understood to be working well. This method, the Pintsch system, is to install lights under heavy glass set flush with the surface of the field and arranged in plan about as shown in Figure 11. The center light is always kept burning while the system is in use and the lights around the circle are used in accordance with the direction in which the wind is blowing. The light on the side of the circle *towards* which the wind is blowing is used to indicate to the pilot where the wheels should be set down, while two or three lights on tbe opposite side are also lit in order to indicate the direction of the wind and, consequently, direction of landing. In the Pintsch system the lights are connected with a wind vane switch so that they automatically change with the wind.

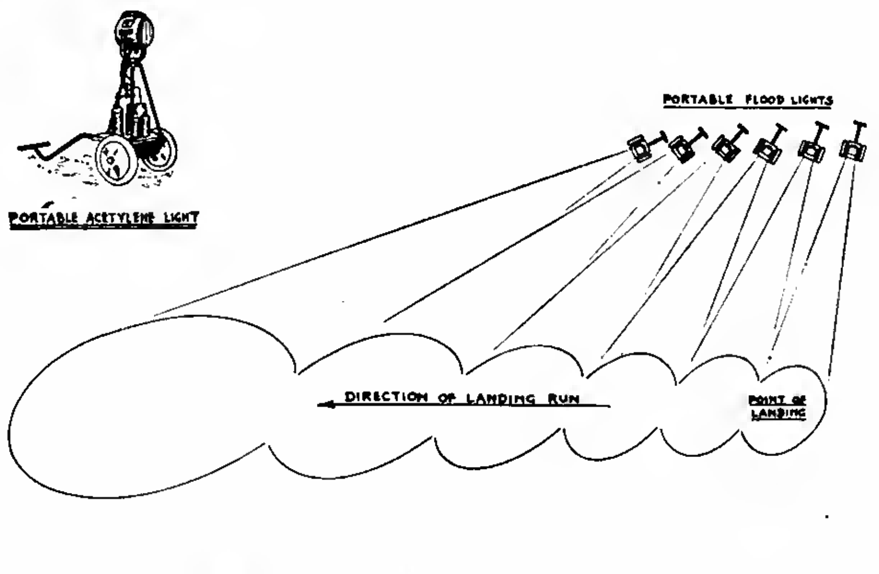

FIG. 10—Floodlight Battery for Night Landings

Beacon Lights

To facilitate finding of the field at night some type of beacon light is necessary. Very elaborate beacons have been installed and are now in experimental use in France and England. Such beacons are only necessary if night flights are to be the regular practice. For a station where only occasional night flights are to be made, and these only in suitable weather, a power-

(Continued on page 40)

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The Effect of Aspect Ratio Variation Upon the Slope of the Lift Curve of an Aerofoil

A SOLUTION of the present problem, based upon the assumption of constant lift curve slope, was given by Lieut. Walter S. Diehl in N. A. C. A. Technical Note No. 79. This supplementary note is prepared for the purpose of giving a general formula which may be applied to any point on the lift curve. The formula offers the quicker method of estimating the slope when a special chart, such as that drawn up by Lieut. Diehl, is not at hand. Practical applications of the results contained herein (as well as in the note referred to above) are to be found in propeller design and in statical stability analysis.

We begin by considering Prandtl's formula for the angle of attack of an infinite wing having the same lift as a finite wing:

$$\epsilon = \alpha - 57.3\,\frac{C_L S}{\pi B^2} \qquad (1)$$

where ϵ = angle of attack, in degrees, of the infinite wing, measured from zero lift.

α = angle of attack, in degrees, of the finite wing, measured from zero lift.

C_L = absolute lift coefficient defined by

$$C_L = \frac{L}{q\,S}$$

where L is the lift, q the dynamic pressure, and S the wing area. For standard conditions $q = \frac{1}{2}\rho V^2 = .001185V^2$, when V is in ft. per sec.

B = wing span.

We have next to consider the aspect ratio:
variation of ϵ with C_L for a given

$$\frac{d\epsilon}{dC_L} = \frac{d\alpha}{dC_L} - 57.3\,\frac{S}{\pi B^2} \qquad (2)$$

Since by definition of aspect ratio, R

$$R = \frac{B^2}{S}$$

equation (2) may be written

$$\frac{d\epsilon}{dC_L} = \frac{d\alpha}{dC_L} - \frac{57.3}{\pi R} \qquad (2a)$$

If, now, (2) is applied to two wings of different aspect ratios, at the same value of C_L, then

$$\left(\frac{d\alpha}{dC_L}\right)_1 - \frac{57.3}{\pi R_1} = \left(\frac{d\alpha}{dC_L}\right)_2 - \frac{57.3}{\pi R_2}$$

Which may he written also

$$\frac{1}{\left(\frac{dC_L}{d\alpha}\right)_1} - \frac{57.3}{\pi R_1} = \frac{1}{\left(\frac{dC_L}{d\alpha}\right)_2} - \frac{57.3}{\pi R_2}$$

It immediately follows, then, that if

$$\frac{dC_L}{d\alpha} = M$$

$$M_2 = \frac{M_1}{1 - \frac{57.3\,M_1}{\pi}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)} \qquad (3)$$

If it is desired to use data with the lift given in lbs./sq. ft. at 1 m.p.h., we note that

$$\frac{dC_L}{d\alpha} = 390.6\,\frac{dK_Y}{d\alpha}$$

and one can write in engineering units

$$M_2 = \frac{M_1}{1 - 7123\,M_1\left(\frac{1}{R_1} - \frac{1}{R_2}\right)} \qquad (3a)$$

The above formulas, depending essentially upon Prandtl's equation (1) are based on an elliptical lift distribution over the span of the wing. Experimental results seem to indicate that this form of assumed distribution for ordinary wings is accurate enough for practical work.

For application in propeller design, the slope of the lift curve of an infinite wing is immediately obtained by letting R_2 approach infinity in formula (3). It is to be noted that when

$$M_2 = M_1 = O$$

the maximum lift has not changed with aspect ratio: a result given by theory and found to be very approximately true in practise.

New Monoplane Control Proves Successful

IT was announced at the Aeronautical Chamber of Commerce that flying tests made recently by Grover Loening, the aeroplane constructor, had demonstrated the complete success of a new type of aeroplane control invented by him that has aroused great interest among aeroplane experts.

The tests were made from the East River off Thirty-first Street, where the Loening factory is located, and for the trials, the monoplane Air Yacht owned by Mr. Harold S. Vanderbilt was used in charge of Mr. Vanderbilt's pilot, S. W. Cogswell.

Since much of the weather during the week consisted of high Northwesterly winds blowing across the river and full of violent and disturbed wind puffs, due to passing over the city, the severest conditions were experienced during the trials.

Ordinarily, flying so near the city under these conditions, with the additional necessity of the hydro-aeroplane having to take to the air from the river sideways to the wind, would have been considered quite impractical and dangerous, but equipped with the new Loening control, the aviators found the machine so responsive in overcoming wind puffs that flying under these conditions was entirely safe.

This significant development is thought by experts to open up a wider field for the aeroplane in that it enables flying to be done under adverse conditions in the very heart of a city, where the air is ordinarily considered too "rough" for flying.

The new invention which is called a lateral "pressure equalizer" is mounted on the extreme tip of each wing and departs radically in its effect from the fundamental principles of lateral control as used in the Wright and Curtiss types of control. Previously used systems for lateral control on wings have always mounted the movable surface or "Aileron" as it is called by aviators, on the rear or trailing edge of the wing, fastened hack of the rear spar of the wing. The competition in the recent air races in Detroit, however, where

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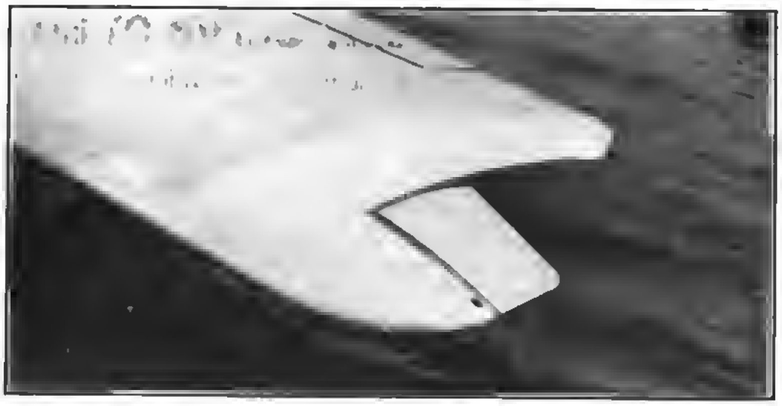
many monoplanes made speeds of over 190 miles an hour, even though not streamlined as well as the biplane racing machines, proved that the old type of control of the monoplanes with an aileron at the rear of the wings became increasingly ineffective with high speed. This feature was studied by many experts and it was found that the tendency of the old type of lateral control was to put twisting stresses on the wing itself which neutralized the controlling power of the ailerons in such a way as to make the machine stiff on the controls.

The "pressure equalizer" invented by Mr. Loening has been found to do away with this effect because the movable surface used to obtain more lift on one side than the other, is placed entirely in front of the center of the wing, so that the effect of this increased pressure in tending to twist the wing causes the twisting stress to be completely reversed in favor of the lateral control instead of against it. The operation of the movable pressure equalizer tending to lift one side of the wing causes the angle of incidence of that side of the wing to increase, thus still further amplifying the controlling power and completely equalizing the twisting stresses induced by the old type of control.



New Loening Control

The construction of the new device is quite simple, in that a small section of the leading edge of the wing is extended out beyond the tip to which is hinged the pressure equalizing flap, which is controlled through cables and levers by the pilot. Mr. Loening claims that the new device is so effective that the use of the trailing edge aileron now practically universal on all aeroplanes may be eliminated entirely and much more controlling power obtained with the new device with 1/4 the area of movable surface, and with a great reduction in the power that it is necessary for the pilot to apply to his control stick.

New Loening Control

The new device is said to again emphasize the qualities of the monoplane in comparison to other types of machines in that it is now possible to preserve its lightness and simplicity without any sacrifice of control whatsoever, and to obtain the best advantage the superiority in speed and climbing power which has already led to the adoption of the monoplane from a commercial standpoint by many constructors throughout the world, such as Fokker in Holland, Dr. Junkers in Germany, DeHaviland in England and the Nieuport Company in France.

The invention can be applied to biplanes and other types of machines but is most valuable for monoplanes due to the depth of chord of their wings.

The successful tests of this leading edge type of aileron to equalize the pressures necessary for lateral control, as developed by Loening, is in favorable contrast to the numerous experiments that have been conducted by constructors and by the government for years with trailing edge ailerons by increasing their size and increasing the size of the "balance" in order to achieve a better lateral control.

England Builds Giant Torpedo Plane

IN GREAT secrecy the Supermarine works is building for the Air Ministry a naval air craft of the torpedo type, with a number of interesting features, at a cost of $160,000.

The hull has been designed for actually "living afloat." The bow is carried very high and has, from ahead, the appearance of a normal motor boat, with the usual stem, sheer and a flare at the top line in addition to the flare on the planing surface. Both flares are designed with a curve to throw spray clear of the air screws.

In the hull is a 60 h. p. aero engine adapted to marine use, with shaft and water propeller leading through the aft step. In place of a standard flywheel is the armature of an electric generator for power for starting motors, the lighting system and for an electric capstan, which is mounted in the bow inside the hull for the handling of a 125-lb. anchor. This engine also drives the bilge pump

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for pumping the 26 water tight compartments. There are two watertight transverse bulkheads and sleeping quarters for five. Of course, a water rudder.

On top of the hull is a streamline superstructure carried just above the middle wing, divided into three compartments, as chart room and the c. o., a central one for two pilots with dual control, and a rear one for a gunner.

The hull is typical Supermarine design, of plywood, with no flat surfaces. The planning surfaces are built on to the hull and act as a double bottom. There are two steps.

The triplane wing structure, including the engine mounts, is built as a unit and is mounted on the hull at three points, with fittings of such a nature that, when necessary to dock the craft, it may go alongside the aircraft carrier or dock and have the complete wing unit lifted off by a crane, in which case it becomes a normal motor boat. The bottom wing is of plywood, while the middle and top wings are of standard construction. The lower wing has a water clearance of about 10 feet. Controls of normal type. The general overall dimensions of the wings are: Spread, lower wing, 46 ft; middle and top wings about 54 ft.; length about 30 ft.; height above water level about 25 ft.; estimated total wing area about 1200 sq. ft.

The power plant consists of two Rolls-Royce "Condors" boosted to 900 h. p. each. The gross weight, with torpedoes, full crew and fuel, is about 21,000 lbs., for 300 miles radius, though the boat is designed to take on fuel for 1000 miles.

Two 3000-lb. torpedoes are to be carried, one suspended under each lower wing root and for these a new releasing gear has been devised.

Five machine guns are to be mounted, one on a ring directly in the nose of the hull, one a ring directly in the tail planes, which are of biplane construction, and three on a single yoke in the rear end of a superstructure built up between the hull and the bottom plane and the middleplane in such a position that the gunner can fire over the top wings. This triple gun yoke is of entirely new design in the general shape of a heart, with the point directed aft, the two loads being carried well over the side and allowing the gunner to fire straight down from either side.

The Stream Tunnel

By Dr. Michael Watter, Curtiss Aeroplane & Motor Corporation

THE attention of everyone interested in aeronautical research is attracted by the news of the successful use in the wind tunnels of mediums other than air at normal pressure. These new wind tunnels have many advantages from an aeronautical point of view but have one big disadvantage, the lack of economy, which cannot be disregarded.

One of the most important aims in Engineering is economy. We have spent too much in the last ten years and an engineer must seriously consider it. The question of economy is of prime importance in aviation. The war gave a very powerful impulse to aeronautical developments but there was one thing which the war did not require and that was economy. As a result, one of the most costly branches of industry nowadays is aeronautics. In aeronautics itself, research is handicapped by the necessity of wind tunnels, the operation of which is rather expensive. Special research requiring large values of *Ve* can be carried out by very few concerns or institutions on account of the lack of facilities.

The desire of economy and the possibility of obtaining the *Ve* effect, gave the writer an idea of the possibility of using a water-tunnel with a natural source of supply. The prime mover would be replaced by gravity. These new stream tunnels demanding almost the same equipment as an ordinary water turbine. The natural water sources and different falls could be employed for these tunnels. Some of these sources would offer a possibility for the erection of a giant stream tunnel, the actual cost of operation would be comparatively small.

The advantages of such a stream tunnel would be,

1. Economy.
2. The possibility of getting *Ve* effect.
3. More natural conditions of flow.
4. The possibility of easy visualisation of flow.

Of course it is very probable that the erection and operation of a stream tunnel would raise some technical difficulties but the writer believes that a detailed study and investigation of this question will help overcome these difficulties.

Flying Between Canada and the United States

General Situation

Canada is a party to the International Convention on Air Navigation and has passed regulations (Air Regulations 1920) governing the conditions under which flying may be carried out within and from Canadian territory. These regulations are essentials in conformity with the terms of the International Convention for Air Navigation.

The United States has not ratified this Convention and has, so far, passed no legislation dealing with the control of aeronautics, nor has it taken steps to authorize any regulating body with such control. Until such a body is created it will not be possible to negotiate an agreement with the United States Government in regard to inter-state flying between the two countries.

Pending the negotiations of such an agreement, as it was desired to grant machines and pilots of United States nationality every facility for flying within this country, the Air Board passed on May 17th, 1920, an amendment to the Air Regulations in the following terms:—

(a) That pending the organization of a body in the United States of America having authority to issue civil certificates to air personnel and until the first of November, 1921, qualified American military pilots be excepted from the provision of Para. 33 of the Air Regulations, 1920, so far as is necessary to put them in the same position with regard to flying in Canada as if they were the holders of certificates from the Government of the United States, that is, in the same position of being entitled to fly United States aircraft in Canada, but not to carry passengers or goods for hire, and

(b) That pending the organization in the United States of a body having authority to issue Registration Certificates for aircraft and until the

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first day of November, 1921, aircraft which would under the convention relating to International Air Navigation be registerable in the United States of America, be excepted from the provisions of Para. 3 of the Air Regulations, 1920, provided that:—

(a) Full particulars of the aircraft are furnished.

(b) The aircraft is marked in accordance with the regulations with a nationality and registration mark of which the first letter is the letter "N" and the second letter is the letter "C".

(c) If such aircraft is one which under the Regulations would require a certificate of airworthiness, a temporary certificate of airworthiness is issued.

(d) In all cases the same fees are paid as in the case of Canadian aircraft.

The Controller of Civil Aviation is to be authorized to administer this exception to the Regulations.

The effect of these regulations was to place aircraft and pilots of United States nationality in the same position as they would have been had that country enacted similar regulations to those existing in Canada.

General Procedure

When an American machine or pilot wishes to cross the International boundary and fly in Canada, notification should be sent, in advance, to the Secretary of the Air Board, Ottawa, giving the date of the proposed flight; the owner's name and address; the pilot's name and qualifications; the type of machine to be used; the route and duration of the proposed flight and the purpose for which it is being undertaken.

Military Aircraft

In the case of Military aircraft (see para. 124 Canadian Air Regulations) notification should be sent, as above, by the proper Military (or Naval) authorities, giving the above particulars and asking that permission should be granted. The officer in charge of the machine should notify the Air Board on his first landing and last departure, and must report to Customs on arrival and departure.

Commercial Aircraft

When a Commercial aircraft wishes to enter Canadian territory, the owner should make application (as in Para. III) in advance, forwarding at the same time a copy of the pilot's graduation or discharge certificate from the United States army or naval service and two passport photographs of the pilot. As there is no authority issuing pilots certificates, other than the Army and Naval Air Services in the United States, and the great majority of pilots had served in either of these services during the War, it was decided to limit the privilege to pilots who had taken the course of training in these services. Exceptions are made in favour of civilian pilots who can produce proof of qualifications equal to those necessary to obtain a pilot's certificate in Canada.

Application for registration of the aircraft, in accordance with the terms of the International Convention, must also be made and the registration markings must be painted on the machines. The Underwriters' Laboratories, it is understood, are allotting registration marks in accordance with the Convention, and their numbers are accepted in Canada. If a machine is not registered with them, the markings are allotted by the Air Board, in all cases commencing with the letters N-C. Full particulars of aircraft must be forwarded with the application for registration. Should the machine be of a type which has not yet been granted a certificate of airworthiness, an investigation of its design is made. If it is found to comply in all essentials with the standards approved in Canada, a type certificate is issued. If, on the other hand it is below the standard called for in Canadian machines, permission is refused to fly it in Canada. The registration fee is $5.00. The fee for a "type certificate" of airworthiness for an individual machine $5.00. Aircraft, engine, and journey log books should be carried on all machines entering Canada.

No commercial operations of any nature are permitted within Canada by United States machines, but they may carry goods or passengers from a point in the United States to a point in Canada, and vice versa.

Private Aircraft

In the case of Private aircraft, the pilot should forward two passport photographs of himself and a copy of his graduation or discharge certificate from the United States Air Service. The application for registration of aircraft should be made and registration markings painted on the machine in the same way as is called for in the case of commercial machines. The Secretary of the Air Board should be notified when machines enter or leave Canadian territory and Customs clearance is to be made at the port of entry and departure. A private license does not allow for flying operations for remuneration or reward to be carried out in Canadian territory, nor is it necessary for a private aircraft to be certified airworthy.

Customs Regulations

The provisions of Part 10, Air Regulations Canada 1920, in regard to reporting to the Customs authorities when entering and leaving Canada are strictly enforced. Owing to the fact that there are so few licensed Customs Airharbours in the country it has not always been possible to enforce regulations 96 calling for an initial and final landing at a Customs Harbour. Arrangements will be made when necessary to have the Customs authorities at the nearest port entry on the harbor make the necessary entries.

(Concluded from page 14)

radio telephone and telegraph. The same conditions apply to the Army and its aircraft.

Consequently we are not surprised to learn that military and naval aeronautical engineers have solved a number of highly important problems in the application of radio to air communication under very trying conditions, and that the apparatus used by the two services is in all respects available for commercial use —a very material contribution to the general welfare. All methods of sending and receiving have been refined and improved by the invention of especially sensitive apparatus unaffected by the vibrations and noises constant in aircraft under power in the air. Once it was necessary to shut off the engine to use the radio telephone while flying, this had been made unnecessary. Not only that, but the Navy has perfected a radio sending outfit which has been named the "Teletype", and which receives a message from a flying plane and writes it on a typewriter as fast as it comes in! The list of new inventions and improvements to older apparatus which is directly chargeable to radio research and experimentation by the Navy's Bureau of Aeronautics is too long to find a place here; suffice to say that results in this one department alone will repay the Nation for all the appropriations under the title "Aeronautical Experimentation."

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PUBLISHED MONTHLY

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Wadsworth Bill Should Pass

THE enactment during the present session of Congress of the Wadsworth bill (S. 3076), establishing a Bureau of Civil Aeronautics in the Department of Commerce, and providing for the regulation and encouragement of flying, is being urged by practically all legitimate flying organizations, including the manufacturers and responsible operators of aircraft.

This bill was introduced by Senator Wadsworth on Aug. 24, 1921, as a result of a conference with Secretary of Commerce Hoover, participated in by representatives of civilian bodies and Governmental agencies concerned, held on July 18, 1921. The bill passed the Senate on Feb. 15 of this year, and on introduction in the House of Representatives was referred to the Committee on Interstate and Foreign Commerce.

In the last nine months the measure has languished in the hands of the committee, of which Representative Samuel E. Winslow of Massachusetts is Chairman. Advocates of its passage say that immediate action will permit some sort of regulation and encouragement to be effected by next spring. Another flying season will pass unguided and uncontrolled, it is pointed out, if the bill is further delayed.

Show Accident Record

Representatives of the Aero Club of America, the Manufacturers' Aircraft Association, National Aircraft Underwriters' Association and the Society of Automotive Engineers attended the conference with Secretary Hoover. At his request the Manufacturers Aircraft Association and later the Aeronautical Chamber of Commerce conducted a survey of hazard in unregulated flight.

The report to Secretary Hoover said:

"It is estimated that, during the calendar year 1921, 1,200 aircraft were engaged in civil flying in the United States, and that these flew 6,500,000 miles, and carried 250,000 persons. These figures are approximate and include both the itinerant and fixed base flying.

"Not including those that involved Government-owned aircraft, 114 accidents occurred. The 114 accidents resulted in death to forty-nine persons and injury, more or less serious, to eighty-nine. The forty-nine lives were lost in thirty-three accidents, and injury to the eighty-nine persons was caused in but forty-two accidents.

"Each of the 114 accidents recorded was caused by deficiency in one or more of the six necessary requisites for safe flying. Forty-nine were attributed to the pilot, perhaps, through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. * * * Therefore at the very top of the list of Governmental needs we place the Federal examination and licensing of pilots.

Want Inspection Rules

"Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the 114 accidents, 22 may be attributed to faults which proper inspection probably would have revealed—four concerning the plane, nine the engine and nine an accessory, gas or oil. This inspection must be made at frequent intervals by Federal authority.

"When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that any one can take any sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons on the ground. If the standard of control were left to the various States the hope of correcting this unfortunate condition would seem remote."

The report cited accidents due to lack of adequate landing fields, lack of weather reports, stunting in the air, and crowds surging into the field. Only Federal rules rigidly enforced could meet these conditions, it was stated. The need of Federal authority to obtain information in such cases was also emphasized.

Army Favors Bill

The bill has been indorsed, in addition to those organizations represented at the conference, by the National Aeronautic Association of the U. S. A., the Army Air Service and Air Mail Section of the Post Office Department, the Department of Commerce and the National Advisory Committee for Aeronautics.

Major General Mason Patrick, head of the Army Air Service, testifying in favor of the bill before the Senate Committee on Commerce, said commercial flying could not assume large proportions until legislation of the nature of this measure was passed.

"It will require large investments," he said, "and capitalists are shy about investing money without proper safeguards."

Senator Wadsworth in explaining the purpose of the bill, made the following statement:

"This bill is also designed to correct a curious and extraordinary situation that is developing in customs and quarantine. Smuggling of persons and goods—including liquor— is easier by air than by many other methods, and contraband flying can not be controlled except by special law with all the force of the Government behind it."

Writing on the Sky

WHEN a British airman, Captain Cyril Turner, employing a device invented by Major John Savage, of London, went up ten thousand feet on Tuesday at the noon hour and wrote on the sky the words "Hello, U. S. A.," in gigantic letters, he made all New York sit up and take notice.

Women neglected their shopping, stock brokers forgot all about the market, taxicab chauffeurs ceased to look for fares; even the traffic policemen in Fifth avenue could not make their eyes behave. For the rest of the day it was the one subject of conversation all over the town.

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Although this very modern way of appealing to the eye of the public has been employed abroad, it was the first time the blue was so used on this side of the Atlantic.

Here is new work for the foes of the billboard and the poster. If the aviation corps of the Police Department have to patrol the empyrean to prevent the hanging out of signs by those without permits they will have their work cut out for them.

It will be interesting to see what the Board of Aldermen produces in the way of an ordinance to meet the situation.

Glider or Aviette

IN the midst of the enthusiasm for gliding which has been aroused during the last few months, there are already signs of a division of opinion as to whether gliding is, after all, likely to carry us much further, or whether we should not do better by devoting our energies to the evolution of a type of power-driven airplane which will fly with engines of a few horse power only. The two schools are both emphatic in their views, but we think that, as usual in such cases, the truth lies somewhere between the two extremes. We have always held that gliding can provide excellent sport, but have never shared the optimistic view that its practice will lead to the development of types of aircraft which will be commercially useful and will be able to make long trips, to a fixed time table and over given routes, by the aid of the energy in the wind only, without other motive power.

The opposite view, that gliding cannot possibly teach us anything, is, to our way of thinking, equally incorrect. Gliding can undoubtedly teach us a good deal about best wing forms, best fuselage shapes, effective controls, and so on. In other words, it provides an opportunity of carrying out, for a very small capital outlay, full-scale experiments which would, if conducted with power-driven machines, cost considerable sums of money. The machine of ultra-low power is certainly a possibility. In fact, it is possible to predict with fair accuracy, without introducing uncertain features, that a small, lightly-loaded, single-seater machine can be built which will fly level—that is to say, will just be able to remain in the air without descending—for a power expenditure of about 4 or 5 horse power. Such a low-powered machine would, however, have no reserve power for climbing, and might easily, we think, be more dangerous than a pure glider in which the pilot would know that no other power was available than that obtainable from the wind.

It has been suggested that progress might be made by fitting a very low power engine in a glider, and merely using the power when the wind dropped or when the machine got out of an ascending current. We very much doubt if such a procedure would be satisfactory. As soon as an engine is fitted the elements of an ordinary airplane are introduced, such as noise, vibration, propeller draught, etc., and it appears to us doubtful whether pilots would be able to change over from gliding to propelled flight, and *vice versa,* sufficiently quickly and at the correct instant to make such a compromise successful. The very presence of an airscrew would detract considerably from the gliding angle of the machine, and then there is the difficulty of starting the engine, should it, as would frequently happen, stop altogether while running throttled down. To re-start would mean a steep dive, with consequent loss of altitude.

To us it seems that the best policy will be to learn as much as we can from pure gliding, and then, with the knowledge thus accumulated, attack the problem of low-power flight afterwards. In that way, much more is likely to be learned than if we start off straight away with "Aviettes." That it will ultimately be possible to fly at a speed of 50 or 60 m. p. h. with a power expenditure of about 10 h. p. we are quite prepared to believe, but before the really satisfactory machine can be evolved which will do this we think a thorough study of gliding and soaring should be made.

The Last of the Hydrogen Ships?

THE recent destruction at San Antonio, Texas, of the Army dirigible C-2, will probably hasten the abandonment of hydrogen and its replacement by helium in all Army and Navy airships. The fire hazard is so great in the case of hydrogen filled ships of the type now used that future military ships will be designed to employ helium as the lifting medium. This is doubtless a wise policy so far as Government-owned ships are concerned, but the high cost of helium and its lower lifting capacity are serious detriments, even though it were available in large quantities, so far as commercial dirigibles are concerned.

The other alternative, as has been pointed out before in these columns, is the development of engines for using less volatile fuels and non-inflammable fabric or other materials which will retain the hydrogen and prevent its ignition even though a flame comes in contact with the surface of the container. There is doubtless much experimental work to be done before this alternative becomes a reality, but research work in this direction is in progress, at least so far as the engine is concerned. All-metal airplanes have been constructed, but whether all-metal construction can be successfully applied in the constuction of dirigibles remains to be seen.

If this comes about competent engineers believe that hydrogen can be employed with comparative safety. On the other hand a combustible gas such as hydrogen will always increase the fire hazard as compared to a non-combustible such as helium, no matter what engine fuel or gas container is employed.

It is hard to conceive of a container which might not be ripped open, for example, in an accident similar to that which occured in the case of the C-2 when strong gusts of wind caught it as it was being taken from the hangar. From a comparatively small rupture hydrogen might issue and burn as a jet, but a large tear might easily release large volumes of gas. Hydrogen and air form a highly combustible mixture the ignition of which might easily result in an explosion of sufficient violence to wreck a ship.

No doubt the problem of safe commercial flight in lighter than air craft will ultimately be solved, but there is still much to be done before such an ideal is realized.—*Automotive Industries.*

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THE NEWS of THE MONTH

Aircraft Safety Code Committee Meets

The general meeting of the committee for the formation of the aircraft safety code was held at the Bureau of Standards, Wednesday, November 8. The meeting was opened by the Chairman, Mr. H. M. Crane, who told of the organization of the committee and the progress of the work to date. The chairmen of the five subcommittees then reported progress in the particular parts of the code assigned to them. This was followed by a general discussion as to the policy of the committee and of some of the more important provisions of the proposed code.

Work on this code has now been in progress for over a year and it is hoped to have it completed by next spring.

Some of the provisions of the code, especially those dealing with traffic rules, licensing of pilots, protection of property, etc., cover matters which are likely soon to become subjects of legislation. In this case the code will serve as a guide to administrators and will enable the governing body to frame rules which will give adequate protection to the public while permitting the free development of the industry.

Drivers of automobiles are familiar with the inconvenience and expense which has been caused by the lack of uniform laws covering the whole country, and by the unwise character of some of the earlier legislation. It is hoped to be able to avoid this difficulty in connection with aircraft by anticipating the demand for suitable regulations and making it possible to get reliable advice on the subject, and to have Federal legislation instead of local.

In the case of those parts of the code which deal primarily with the design, construction, and testing of aircraft it is not considered wise to have its provisions embodied in legislation. These provisions can be much more readily enforced by those who are interested in and familiar with the industry, as is now done in the case of professional ethics among engineers.

The development of aircraft is making very rapid progress. Practices which are unwise in the present state of the art may soon prove desirable as a result of improvements. It is therefore considered desirable to have general legislation covering the industry, but to leave the detailed application of it in the hands of a competent administrator.

In the formulation of the code each subcommittee is assigned to a certain part. They make a draft of the rules proposed, and after thorough discussion in the subcommittee these are sent out to all the members of the committee and to all those who are competent to criticise them and offer suggestions. Then they are revised, and are submitted to the committee at its next meeting for final approval.

There are five subcommittees, dealing respectively with airplane structures; engines; equipment and maintenance; lighter-than-air craft; traffic rules; signals; licensing of pilots; landing fields; etc.

The committee is sponsored by the Bureau of Standards and the Society of Automotive Engineers, who do the clerical work and coördinate the entire task. It is representative of all the important organizations in the country who are interested in aircraft.

Officers of the Committee

Chairman: H. M. Crane, 44 West 44th Street, New York City. Vice Chairman: Prof. J. S. Ames, Johns Hopkins University, Baltimore, Md. Secretary: Dr. M. G. Lloyd, Bureau of Standards, Washington, D. C. Vice Secretary: A. Halsted, Bureau of Standards, Washington, D. C.

Chairman of Subcommittees

Airplane Structures—

Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge, Mass., Representing American Society of Mechanical Engineers.

Power Plants—

Geo. J. Mead, Wright Aeronautical Corporation, Paterson, N. J., Representing Society of Automotive Engineers.

Equipment and Maintenance—

Archibald Black, 25 Brixton Road, Garden City, Long Island, Representing Society of Automotive Engineers.

Lighter-than-Air-Craft—

R. H. Upson, Aircraft Development Corporation, General Motors Building, Detroit, Michigan, Representing Society of Automotive Engineers.

Traffic Rules, Landing Fields, Pilots, Signals, Etc.—

A. Halsted, Bureau of Standards, Washington, D. C., Representing Bureau of Standards.

As all national safety codes are established under the direction of the American Engineering Standards Committee, it was felt by the initiators of the aeronautic code that the latter should be initiated by this same body.

The American Engineering Standards Committee, at its meeting of October 9, 1920, appointed a sectional committee for safety codes, with the Bureau of Standards and the S. A. E. acting as joint sponsors for that committee. The following organizations were requested to designate representatives on the sectional committee: War Dept., Navy Dept., Post Office Dept., Coast Guard, N. A. C. A., National Safety Council, Underwriters' Laboratories, National Aircraft Underwriters' Ass'n, U. S. Forest Service, Manufacturers Aircraft Ass'n, Aero Club of America, Am. Soc. Mech. Egrs., and Am. Soc. of Safety Egrs.

The Bureau of Standards and the Soc. of Automotive Engineers, acting as sponsors, prepared a complete synopsis of a safety code for aeronautics, which was distributed to the various organizations to be represented on the sectional committee.

A meeting for organization purposes was held in Washington on May 13, 1921, for consideration of scope and method of development of the code. Another meeting was held in New York, Sept. 7, at which permanent organization was effected, the officers consisting of a chairman, H. M. Crane, of the S. A. E.; vice-chairman Dr. J. S. Ames of the N. A. C. A; and secretary M. G. Lloyd, of the Bureau of Standards. Five sub-committees were appointed to deal with the subject matter, as follows: Airplane structure, including design, construction and test; power plants for aircraft, including design, construction and test; equipment and maintenance of airplanes; lighter-than-air craft; aerodromes and traffic rules, including landing fields, air ports, traffic rules and qualifications of pilots.

Germans Plan Dirigible Line Here

According to the Berlin corre-

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spondent of the New York Herald a plan for the establishment of numerous new air lines in the United States with the combined technical skill of Germany and American capital was brought back recently by Herr Schuette of the Schuette Lanz dirigible works, one of the most extensive concerns of the country during the war.

Herr Schuette declares that plans are practically perfected for the opening of a line from New York to Chicago with craft of German design having capacities of from 110,000 to 150,000 cubic meters. Working out of such craft in this country was forbidden after the war by the treaty. Hence the proposal to build and operate them in America would result both in development of American air lines, which is much desired there, and at the same time preserve German interest in continuing the development of air navigation.

Herr Schuette declared that the airships of the capacity planned for the New York-Chicago line are as small as can be built and still give satisfaction. They afford passenger space enough to make the business a paying one and give room on board for all modern comforts. The plans show restaurants, smoking rooms, sleeping and living compartments, baths and promenade decks, the speed is reckoned at 100 kilometers per hour and could be increased to 140 kilometers or about eighty-seven miles.

Herr Schuette declares that the service can easily be extended to any part of the United States if the proper repair shops and landing stages are constructed. The method he proposes would permit landings in the center of cities by overhead stages. He said that once a country with the resources and ingenuity of America takes advantage of the steps attained by the German builders, transatlantic lines would be within the realms of possibility and round the world lines would be the next development.

Until recently when at the international air convention restrictions were withdrawn flying had suffered greatly in Germany. Now, however, planes can pass over countries of Powers represented at the convention, but building of the larger types is still forbidden by rules drawn up at the conclusion of the war. Airplane lines developed greatly in Germany during the summer and, while many of them did not connect with outside lines, they did much to keep the interest of plane builders alive.

Perhaps the biggest development was the establishment of the route from Köenigsburg to Moscow. This is considered so important that it will be kept up throughout the winter while many other lines are abandoned. The London to Berlin line, just now being got into shape for operation is another big achievement of the year.

"What we have lacked heretofore," said Major von Tschudi, one of the most important figures in Germany's air activities, "was connecttions with other lines. This lack was not altogether due to political reasons. It is true that flying over some countries was forbidden, but, as in the case of the Berlin-Moscow line, the distance from Berlin to Köenigsburg was not made by air because it was considered more convenient to passengers. A number of reasons lay behind the lack of coordination among the various countries, including lack of subsidies for opening routes through territories where good connections could be made. The way is in sight now, however, for connections with the French line from Paris to Warsaw, touching Prague and Strassbourg and with the line from Breslau to Budapest via Vienna. The idea of state subsidies has been recognized by the German Government, but thus far the service has not been given great impetus by the money received.

"Good organization and connections with lines to other countries, however, combined with improved planes, will make vast improvements in coming years."

The Collier Trophy

Contenders for the Collier Trophy should present their claims in writing to the "Collier Trophy Committee, National Aeronautic Association, 26 Jackson Place, Washington, D. C." before Monday, January 1, 1923.

The Collier trophy is of bronze, and was presented by Robert J. Collier, Esq. The trophy is to be awarded annually for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by use during the preceding year.

The first award was given to Mr. Glenn H. Curtiss for his development and demonstration of the hydroairplane during the year 1911.

The trophy for the year was again awarded to Mr. Glenn H. Curtiss for his development and thorough demonstration of the flying boat, in which buoyancy is supplied by the fuselage.

In 1913 the trophy was awarded to Mr. Orville Wright in recognition of the development and demonstration of his automatic stabilizer.

For 1914 the trophy was awarded to Mr. Elmer A. Sperry for his work in achieving the automatic control of an airplane by means of the gyroscope.

The trophy for the year 1915 was awarded to Mr. W. Starling Burgess, of Marblehead, Mass., in recognition of his development and demonstration of the Burgess-Dunne hydroairplane during the year 1915.

The trophy for 1916 was awarded to Mr. Elmer A. Sperry for the development and thorough demonstration of the Sperry Drift Set.

This trophy was not awarded during 1917 or 1918 on account of the war.

In 1921 this trophy was awarded to Mr. Grover C. Loening, for the development and demonstration of his aerial yacht.

The Collier Trophy Committee consists of: Dr. George W. Lewis, Chairman, Mr. Porter H. Adams, Mr. Maurice J. Cleary, Mr. B. Russell Shaw.

Harding Endorses Aeronautics Policy

Endorsing the National Advisory Committee for Aeronautics' plea for the fostering of aeronautics development in this country, the President has forwarded the eighth annual report of this body of scientists to Congress with the statement that:

"The constructive recommendations therein contained for the advancement of aeronautics deserve the thoughtful consideration of all members of the Congress."

In presenting the eighth annual report of the National Advisory Committee for Aeronautics to the President, Dr. Charles D. Walcott, Chairman of the Committee, points out that the contributions of the Committee to the science of aeronautics have placed America in the forefront of progressive nations in aerial navigation. "In the art of aviation there has been substantial progress in the design and performance of military and naval types of airplanes, but commercial aviation has made very little headway," he states, adding that this is due, not so much to the inherent problems and difficulties of air navigation, nor the lack of technical knowledge, as to the lack of airways, landing fields, and Federal Regulation and licensing of aircraft and operators. Calling attention that the development of world transportation both by rail and road has depended largely on governmental aid, Dr. Walcott states that aircraft will prove even more revolutionary than railroad and automobile devel-

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opment. "In the opinion of the National Advisory Committee for Aeronautics, he explains, "it is necessary and proper that the Federal Government should aid in the development of air navigation by providing Federal regulations and establishing airways and landing fields."

A policy for the development of aeronautics as a national asset beneficial in time of peace as well as in time of war, is outlined in the Committee's report. The relative importance of aviation in war alone is said to be of sufficient importance to justify the expenditure of public funds to aid the development of aerial navigation on a commercial basis. The history of civilized nations shows, the report states, that governments have found it necessary to aid in developing all transportation systems, and that today the progressive nations of Europe are spending large sums, through direct and indirect subsidies for the promotion of civil and commercial aviation. Without asking financial assistance for the art, the report states that the practical development of aviation in America will be realized only when this Government gives intelligent support and effective aid, principally by regulating and licensing airplanes and pilots, and with state coöperation in establishing airways and landing fields.

Briefly, the National Aeronautical Policy recommended provides that:

Aeronautics has already exerted a great influence on civilization, its necessity in military operations being definitely established, although its adaptation to commercial purposes has scarcely commenced.

Lack of restriction of aircraft development by the Limitation of Arms Conference, is believed sufficient to assure greater relative importance in future warfare on both land and sea.

Practical application of aviation in Air Mail Service within a few years, is one of the marvels of the age. Each improvement in transportation is known to have lightened man's labors, increased his prosperity and broadened his knowledge of his fellow man. The continuance of the service is recommended.

With the help of well-directed scientific research, with the imagination of the people fully aroused, and with comprehensive, helpful legislation, aeronautics will yield in peaceful pursuits its real contribution to the progress of civilization.

Scientific research in aeronautics is said to be the most important subject in the field of aerial navigation development; the Army and Naval services depend upon the work of the Committee for the solution of the more difficult problems in the fundamental art of flight, which is the prescribed function of the Committee. The urgent need for ample funds and facilities with which to complete the execution of a research program already approved, is explained.

Federal regulation of aviation, with state coöperation, is urged by the Committee, which also recommends the creation by law of a bureau of civil aeronautics under the Department of Commerce.

Although public sentiment seems to be urging the reduction of the Army and Navy to a pre-war basis, it is the judgment of the Committee that the public does not demand that the air services of those arms be so reduced, nor even that they be reduced proportionately with the other branches of the Army and Navy. The novelty of aerial warfare, the lack of civil aviation activities from which to draw in time of need, the rapid development of aeronautics in other countries, and the necessity for aviation in national defense, have led the people to support a policy of progress and development in aeronautical branches of both the Army and Navy, however much they may insist upon curtailment of other military expenditures, it is claimed.

The Committee urges the development of our helium extraction methods and the conservation of this unique supply of non-inflammable lifting gas, through the acquisition of the fields and the sealing of the wells.

The development of aerological service along transcontinental airways, when established, is requested, and the authority for the extension of this work by the Weather Bureau is urged, as without an aerological service, it is explained, there can be no safety in the air nor progress in commercial aviation.

Colonel Lahm and the N. A. A.

Colonel Frank P. Lahm, with the Army Air Service and one of the oldest American fliers, with a distinguished war service, has been appointed Chairman of the Contest Committee of the National Aeronautic Association of U. S. A.

Owing to the importance of this committee which has charge of the American Pulitzer Races and all other contests, sports and aeronautic races in this country, and which furnishes Officers to observe and authenticate all aeronautic records not only in the United States but in connection with the Féderation Aéronautic Internationale, the world-governing association for the homologation of aeronautical sport and contest records, it was necessary for the National Aeronautic Association to place at the head of this committee the most competent man available in the country. It is therefore, a recognition of Colonel Lahm's qualifications that he was selected to head this vital committee, the activities of which are of immense importance to the development of aeronautics in America. It is through sports and contests properly regulated and controlled that peak performances are obtained which point the way to aeronautical engineers and manufacturers engaged in forward looking programs of aeronautic research, experiment, manufacture, and operation.

Colonel Lahm is now on duty at the office of the Chief of Air Service, Washington, D. C. He is a graduate of West Point Military Academy and began his duties in connection with aeronautics in France in September and October, 1906, where he won the first Gordon-Bennett Balloon Race at Paris; he was next in charge of the Wright Airplane tests at Fort Meyer, Va., 1908-1909; was winner of the National Balloon Race at St. Louis in 1911, and organized the Army Air Service in the Philippine Islands in 1912. During the war he was at Headquarters A. E. F. and Headquarters, Air Service of Advance, October 1, 1917 to July 26, 1918; with Headquarters, First Army, A. E. F. from that date to October 12, 1918 and thereafter until April, 1919, commanded the Air Service, Second Army, A. E. F.

Colonel Lahm is a military aviator, holds American License No. 3, Spherical balloon pilot; American License No. 2, dirigible balloon pilot; American Aviator's Certificate No. 2 for airplane pilot; and American Expert's Certificate No. 15, for airplane pilot.

Colonel Lahm has already begun work on the details of the Pulitzer races to be held in 1923.

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Pioneer Instrument Company

The Pioneer Instrument Company announces that they have purchased the entire aircraft instrument business of the Lawrence Sperry Aircraft Company, and have acquired an exclusive license under their aircraft instrument patents. Licenses under certain patents of the Sperry Gyroscope Company have also been secured.

The Lawrence Sperry Aircraft Company will continue its manufacture of airplanes. They have a modern and well-equipped plant at Farmingdale, L. I., with an adjoining flying field.

The manufacture of both SPERRY and PIONEER aircraft instruments will now be handled exclusively by the Pioneer Company.

Young Discusses European Situation

Recent record performances of American airplanes have spurred on the European nations to unprecedented effort in aviation, according to W. C. Young, manager of the Aeronautics Department of the Goodyear Tire and Rubber Company, and a Governor of the Aeronautical Chamber of Commerce, who returned recently from an investigation of the aeronautical situation in England, France, Germany and Spain. He said that every effort is being made in both England and France to produce new aircraft capable of outflying American products in speed and performance.

"Germany today ranks first among the nations in all-metal construction," said Mr. Young. "France is building many new types of airplanes, seeking machines with low operating cost such as economy in fuel consumption coupled with high performance. England has been working hard to develop fast ships; and France is now building new long distance commercial types.

"Spain learned a lesson during the Moroccan campaign; and has adopted an aviation policy calculated to develop both her military and commercial air power. Both airplanes and airships will be employed. Spain is convinced that the lighter-than-air craft has an immediate future: and is planning to employ the dirigible and the smaller non-rigid ships in maintaining a patrol of her frontiers, as well as linking up with South American countries commercially. Germany so far leads the world in the construction of the great rigid airships of the Zeppelin type. I think, however, that small non-rigid airships built in the United States are unsurpassed in any European country."

Air Law Survey

Forty countries have national air laws regulating the operation of civilian aircraft and designed to decrease flying accidents due to reckless piloting, according to a survey which the Aeronautical Chamber of Commerce of America has forwarded to the Department of Commerce.

"Twenty-six nations which ratified the International Air Convention drawn up following the Armistice, have established national legislation providing for safe and sane flying within their own borders," the Chamber finds. "Fourteen other nations have various kinds of national air laws.

"Of the remaining countries on earth, those which have not yet passed air laws tending to safeguard the passengers and the lives and property of the public, include Abyssynia, Persia, Bhutan, Nepal, Oman and the United States.

"All aviation organizations have co-operated in urging the passage of the Wadsworth Bill providing for a bureau of civilian aeronautics in the Department of Commerce. The measure, if it became a law, would regulate all civilian flying, provide penalties for reckless pilots and purveyors of unsafe machines and would prescribe means for protecting property on the ground.

"It passed the Senate last February. The House as yet has taken no action."

Comparative Strength of Air-Dried and Kiln-Dried Wood

Some wood users claim that kiln-dried wood is brash and not equal in strength to wood that is air-dried. Others advance figures purporting to show that kiln-dried wood is much stronger than air-dried. But some 150,000 comparative strength tests, made by the Forest Products Laboratory, of the U. S. Forest Service, on kiln-dried and air-dried specimens of 28 common species of wood show that good kiln drying and good air drying have the same effect upon the strength of wood.

The belief that kiln drying produces stronger wood than air drying is usually the result of failure to consider differences in moisture content. The moisture content of wood on leaving the kiln is generally from 2 to 6 per cent lower than that of thoroughly air-dried stock. Since wood rapidly increases in strength with loss of moisture, higher strength values may be obtained from kiln-dried than from air-dried wood. Such a difference in strength has no significance, since in use a piece of wood will come to practically the same moisture condition whether it is kiln-dried or air-dried.

It must be emphasized that the appearance of the dried wood is not a reliable criterion of the effect the drying process has had upon its strength. The strength properties may be seriously injured without visible damage to the wood. Also, it has been found that the same kiln-drying process can not be applied with equal success to all species. To insure uninjured kiln-dried material, a knowledge of the correct kiln conditions to use with stock of a given species, grade, and thickness, and a record showing that no more severe treatment has been employed, are necessary.

Chicago-Seattle Air Mail

Chambers of Commerce in nearly every community between Chicago and Seattle are working hard to secure an air mail service between the two cities.

A Good Performance

Walter Beach, Chief Pilot for the E. M. Laird Company, Wichita, Kansas, recently completed a remarkable trip covering 2,229 miles by air. He was aloft thirty-two hours. Straight flying from Wichita to Detroit, which was one of Beach's objectives, by way of Chicago and return is 1,718 miles. Side trips were made to Mt. Clemens, Toledo, Minneapolis, Fort Dodge, Red Oak, Forest Park and other towns.

London Newspapers by Air

37.4 tons of newspapers are carried from London to the continent

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every month—an average of more than a ton daily. Newspapers represent about one-half the total cargo of the British, French and Dutch aircraft.

Possibilities in Mexico

William G. Shauffler, Jr. returned recently from a business trip in Mexico where he reports unusual opportunities existing for the development of air transport. He has an interesting proposition where two types of planes may be required; (1) two passenger small machines, capable of a quick getaway with full load at 7,800 feet above sea level. (2) cargo planes carrying reasonable pay loads. Interested persons are advised to communicate with him, care L. V. D., 349 Madison Ave., New York City.

Automobile and Gas Engine Encyclopedia

The new edition of Dyke's Automobile Encyclopedia is ready! Inasmuch as the old edition was considered one of the best practical handbooks for drivers, repairmen and students seeking to fit themselves as automobile mechanics, the later volume will receive a sure welcome.

Included in the 1238 pages are the answers to nearly every problem and question that may come up in your work or studies regarding the mechanism of an automobile. Starting motors, generators, universal joints, electrical parts, etc. are thoroughly treated.

In order that the reader may be informed before he passes the ignition or the other electrical subjects, the elementary principles of electricity and magnetism are presented. Also a complete diagnosis of all possible electrical troubles is given.

There's a handy index of 14,000 captions which makes it possible to quickly get to the right page or the necessary diagram. With over 4000 illustrations intelligently explained and a dictionary of motoring terms, the new edition should be of real worth to every one in the industry who needs a hook to "stand at his right hand" and answer questions when, as and if required.

The book may be secured from Goodheart-Willcox Company, Inc., of Chicago; $6.00 for the cloth hound copy and $7.50 for flexible morocco.

Personal Par

Mr. H. Barber, F. R. Ae. S. the well-known Aeronautical Consultant and Underwriter, announces that Mr. Robert H. Baldwin is now associated with him in business at 30 East 42nd Street, New York. Mr. Baldwin has had some ten years experience in insurance and banking and, during the war, qualified as an artillery air observer and saw considerable active service in France.

New Publications of National Advisory Committee for Aeronautics

In accordance with the policy of *Aerial Age* of indicating to readers all sources of information on every subject connected with aeronautics, it is printing from time to time lists of reports, notes and the like which are available to the public from Government sources. Following is a list of several new Reports of the N. A. C. A. A complete list of those published heretofore was printed in the November number.

No. 145. Internal Stresses in Laminated Construction. 10c.

No. 150, Pressure Distribution over Thick Aerofoils—Model Tests. 5c.

No. 152. The Aerodynamic Properties of Thick Aerofoils II. 5c.

No.153. Controllability and Maneuverability of Airplanes. 5c.

The above may be purchased at the price noted by money order or cash from Superintendent of Documents, Government Printing Office, Washington, D. C.

Airships Incorporated

The Airship Manufacturing Company of America has been incorporated under the name of "Airships Incorporated."

Charles C. Witmer and Beckwith Havens were the partners operating under the name of the Airship Manufacturing Company of America.

"Airships Incorporated" is incorporated by Charles C. Whitmer, Beckwith Havens and James F. Boyle, these three being the only stockholders. The policies and organization of The Airship Manufacturing Company of America will be in no way affected by this change.

All contracts now in hand will be finished by The Airship Manufacturing Company of America but all new business will be taken on in the name of "Airships Incorporated."

The Officers of "Airships Incorporated" are as follows: President, Charles C. Witmer; Vice Pres., Beckwith Havens; Sec. & Treas., James F. Boyle.

Orville Wright and Gliding

In order to foster and encourage Glider Contests in the United States, the National Aeronautic Association of U. S. A. has appointed a subcommittee to investigate and report on Glider Contests, suitable locations, and times of the year in which Glider Contests may be successfully conducted, and to furnish data to interested persons who desire to compete in such contests.

The Chairman of this committee is Orville Wright, who nineteen years ago, made the first flight in a mechanically propelled "heavier-than air" machine.

Mr. Wright will be assisted in his labors by the following members of the committee: Dr. George W. Lewis, Executive Secretary of the National Advisory Committee for Aeronautics; Professor E. P. Warner, in charge of Aeronautical Department at the Massachusetts Institute of Technology; Mr. E. T. Allen, of Massachusetts Institute of Technology, who took the M. I. T. Glider abroad last summer in the French and German Glider Contests; and, B. Russel Shaw.

Mr. Shaw is the Executive Vice-Chairman of the Contest Committee of the National Aeronautic Association, and states that the sub-committee represents the best qualified aeronautical experts in this country to carry out the duties involved.

Mr. Wright himself, has had much experience in Gliding, the successful design of the Wright Brothers' first airplane, being largely due to data and experienced gained from gliding. Mr. Wright's record for hovering over one spot, has never been equalled, although more than 20 years have elapsed since the Kitty Hawk exhibition. Professor Warner is one of the world's greatest aerodynamic engineers and was a witness to the German and French Glider Contests of this year, while Mr. Allen was the Pilot of the Glider that Professor Warner designed.

Loening to Study Air Lines in Europe

Grover Loening, the aeroplane constructor who built the Air Yachts used last summer around New York City and Newport by Harold S. Vanderbilt, Vincent Astor and others, sailed recently for Europe.

In connection with projects now being studied for air lines next summer from New York to Newport, Southampton and other nearby resorts, Mr. Loening will make an investigation of the organization and equipment used on several European Air Lines, studying the French, English and German methods and their latest developments.

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Secretary of the Navy Reports

The Secretary of the Navy in his annual report to Congress discusses Naval aeronautics as follows:

"The development of aviation as an integral part of the fleet, with types of aircraft suited to every need of the naval forces, has been the outstanding feature of the past year in naval aeronautics. The rapid strides that have been made in organization and development work have fully justified the establishment of the Bureau of Aeronautics, and the work of this bureau is also reflected in the general contribution that has been made to the advancement of industrial and commercial aviation in this country.

"The catapulting of a service type seaplane from the deck of the U. S. S. *Maryland* is a forerunner of providing aerial defense to every type of surface ship, and the catapult developed by the Navy will find a wide commercial application in the future. The conversion of two battle cruisers under construction into aircraft carriers has been recently authorized by Congress, and may be cited as the most progressive step yet taken to place aircraft with the fleet. The production of helium gas from July to November of 1921, at the United States helium production plant No. 1, was a help to lighter-than-air development, and preceded the first flight in the history of the world of an airship filled with helium gas—that of the C-7 from the naval air station, Hampton Roads, Va., to Washington, D. C., and return.

"The construction of fleet airship *No. 1* at the naval air station, Lakehurst, N. J., is estimated at more than 60 per cent complete, and contracts have been signed for acquisition by the United States of a 70,000 cubic meter airship to be delivered by the German Government on reparations account. The importance of airship development by the Navy will be felt in commercial and industrial enterprise.

"The successful development of torpedo-carrying seaplanes and of ship planes, and the commissioning of our first airplane carrier, the *Langley*, are also outstanding features of the year.

"These and other aeronautical accomplishments brought to a successful conclusion during the past year, have been consummated, in conformity with the aviation policy enunciated in my last year's report, to place an adequate air force in the fleet as an integral part of it, and to operate with it at any time, wherever it may be."

The Navy Spotting Plane

To direct the fire of battleships from the air a new type of plane designed under Navy specifications has been undergoing test by a trial board during the past week and according to opinions of experts in the Bureau of Aeronautics of the Navy Department gives every promise of success.

The new plane will be in effect a battleship mast ten thousand feet high in that it will enable the observer to witness the effect of big gun fire from this altitude and communicate his observations by radio to the firing ship. The plane is known in official parlance as the MO-1. It is a three seater monoplane with an all metal frame construction of aluminum alloy and is designed for spotting and for short distance reconnaissance work.

The spotting plane is a post war development in naval aviation and is a product of the policy of fitting aircraft to the needs of the Navy. Airplane spotting as a practical method of fire control has been thoroughly worked out in target practices held by the battleships during the past two years but the planes used for the purpose were adaptations of existing types and were not altogether suited to the service requirements. The MO, Martin Observation, has been specially designed to become an integral part of the fire control organization of the modern battleship and as such will have an important bearing on the accuracy of naval gunnery.

The new plane was built at Cleveland by the Glenn L. Martin Company, builders of the widely known Martin Bomber and official tests have been under way at the builder's plant. The development of a spotting plane is another step in the way of providing aircraft specially equipped and specially suited to naval requirements. Prior to the war little more was expected or required of planes than that they fly. During the war the tendency was toward the development of bombing and scouting planes to combat the submarine menace, but since the Armistice the needs of the Navy in aviation have been the subject of careful study which has resulted in a specialized development of types. This was reflected in the F-5-L scouting planes, the recently developed Douglas torpedo planes, the TS combat planes, and now the three seater spotter. The new planes will be equipped with a 350 H. P. Curtis engine.

To suit the varied conditions under which a naval plane must operate the MO is designed for interchangeable landing gear, which will make it adaptable for landing and taking off from the deck of an airplane carrier, or in place of wheels for landing and taking off, pontoons may be substituted which will permit of landing and taking off from water. The plane is also designed to be quickly assembled and knocked down for stowage in a small space, a feature that will make it particularly suited to conditions on shipboard. The all metal

New Navy Spotting Plane which will be used to control Ship Fire.

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conducted by the Bureau of Aeronautics in the use of duralumin for aircraft building and established a practice which will be of incalculable benefit to the aircraft industry in this country.

Spotting of gunfire from the air marks a new epoch in modern gunnery. Heretofore and from time immemorial the fall of shots on an enemy target were observed from the mast head of the ships and the accuracy of fire was communicated to the gunners by the observers. With the adaptation of aircraft to spotting the observer now hovers over the line of fire and the panorama of the naval battle is spread out below him. Estimates of distances can be made with the greatest accuracy. The information thus obtained is quickly and accurately communicated to the firing ships by radio installation in the plane and developments in this line, which have kept pace with aviation, enable a well nigh perfect communication system to be maintained.

Official Report of Endurance of Lieuts. Kelly and Macready

Complying with orders from the Chief of Air Service, the Army Air Service Transport T-2 left McCook Field, Dayton, Ohio, for Rockwell Field, San Diego, Calif., on Sept. 19, 1922, for the purpose of making a transcontinental non-stop flight from San Diego to New York, carrying as pilots 1st Lieuts. Oakley G. Kelly and John A. Macready, and as mechanicians, Charles Dworack and Clyde Reitz.

Stops were made en route at Scott Field, Belleville, Ill.; Fort Sill, Lawton, Okla.; and Fort Bliss, El Paso, Texas.

The first leg of the flight to San Diego from McCook Field to Scott Field, 320 miles, was made without especial incident, although rain and clouds were encountered between Terre Haute, Ind., and St. Louis. Lieut. Macready piloted the ship on this trip. The 320 miles were flown in 4 hours at an average speed of 80 miles per hour. Owing to the fact that both tachometers failed, it was impossible to note the R. P. M. It is believed that this was close to 1500.

The airplane was serviced at Belleville with 125 gallons of gasoline and 9 gallons of oil. Sept. 20th was spent at Scott Field, rain, low clouds and fog making the visibility too poor to attempt flight with the Transport, although the engine was warmed up ready for a take-off at 4:30 a. m. The next day was still very cloudy with low fog. A reconnaissance flight in a DH was made toward Springfield, Mo., by the two pilots, as a result of which it was deemed advisable to take off for Lawton, Okla., at 11:30 a. m., although weather conditions were not good. The visibility over the Ozark Mountains to Springfield, Mo., was poor. Clouds were below the mountain tops in many places and the ceiling was less than 500 feet. Clear conditions existed west of Springfield. Lieut. Kelly piloted the plane.

A landing was made at Fort Sill at 5:45 p. m., after covering 550 miles in 5 hours and 46 minutes, an average speed of approximately 100 miles per hour at 1440 r. p. m. This excellent average was primarily due to a favorable wind. Powerful searchlights were thrown on the plane and the work of preparing for the next morning's flight was accomplished at night. The officers and personnel at Fort Sill co-operated to the fullest extent.

The take-off for El Paso was made the next morning at 8:05 a. m., Lieut. Macready pilot. A due west compass course was flown for 270 miles to a point north of Farwell, Texas, and then southwest 100 miles to Roswell, N. M.

It was intended to fly a straight compass course through a pass in the Sacramento Mountains between Roswell, N. M., and El Paso, Texas, but due to extremely rough and bumpy air over barren, jagged peaks for over 100 miles, and the fact that this pass, 7500 feet elevation, was higher than the ceiling of the airplane with the heavy load, it was found impossible to cross the mountains at the intended point. This was the most difficult point of the entire journey. The most efficient climb and the best altitude could not be gained, as the extreme roughness and bumpiness of the air would jar and raise the carburetor float causing the engine to cut out or entirely cease operation for short periods with a resultant loss of altitude just at the time an unusually rough peak threatened to swipe off the landing gear or wing tips.

For the first 100 miles of this leg of the journey there was a favorable east wind which changed to a strong south wind for the ensuing 170 miles and then due to the change in direction of flight from west to southwest at Farwell, Texas, it was necessary to "buck" a head wind for 230 miles.

Considerable anxiety was caused both pilots and crew by the rapidly decreasing gasoline supply and the fact that the sylphon gasoline pump was now leaking due to an internal crack in the first lower left sylphon, which was continually pumping a spray of gasoline from the drain.

A landing was made at Fort Bliss at 3:35 p. m. covering the 550 miles in 7 hours, 30 minutes, at an average of 73.3 miles per hour.

Saturday, Sept. 24th, the sylphon pump was removed and found to be cracked. Although a wire had been sent for a new sylphon pump upon landing the day before, it was decided to repair this pump by soldering and continue the flight to San Diego. The repair work was completed, the pump installed and the airplane serviced with 190 gallons of gasoline and 7 gallons of oil.

Due to the high altitude of the flying field at Fort Bliss (3800 feet) it was decided to allow Mr. Dworack and Mr. Reitz to proceed by rail to San Diego. They proceeded via Southern Pacific Railroad that evening at 10:05. The load was thus reduced by approximately 500 pounds, practically all of the baggage being transferred by rail from this point.

The airplane left Fort Bliss on Sunday at 6:48 a. m., with a total weight of approximately 7500 pounds. No trouble was encountered in the take-off, while a climb to 2,000 above ground level was made in 16 minutes. The vicinity of the airdrome was left at 6:55 a. m. Deming, N. M., 80 miles, was passed at 7:45; Lordsburg, N. M., 140 miles, at 8:18; Bowie, Arizona, 190 miles, at 8:45; Tucson, Arizona, 290 miles, at 9:45: The Southern Pacific Railroad was followed to Tucson, but from Tucson to Yuma an airline course passing just south of Ajo, Ariz., was chosen. This 220 miles was made in 2½ hours during which time no available landing field was sighted and not a sign of life was observed. This country is almost entirely composed of rough, rugged volcanic peaks, with apparently no life or vegetation existing.

San Diego was reached at 2:10 p. m. The 650 miles were covered in 7 hours, 15 minutes, at an average speed of approximately 90 miles per hour. Sixty-six gallons of gasoline and nine gallons of oil were drained.

Mr. Dworack and Mr. Reitz arrived Monday, Sept. 25th, at 7:20 a. m. Arrangements were made with the Commanding Officer, Rockwell Air Intermediate Depot, regarding the necessary assistance, including labor and material to install a new engine and prepare the airplane in general for the coming non-stop transcontinental flight. After arranging these details the flying field was inspected by driving across at various angles and carefully measuring each course by the speedometer. It was found that a run way of one and seven-tenths miles was available in the direction of the prevailing wind. As the flying field had been inactive for

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several years, a certain amount of work was necessary to prepare this as an ideal take-off, due to the clumps of bunch grass and sandy soil.

The Commanding Officer, McCook Field, was wired requesting the sub-allotment of $300 to cover the payment of civilian labor necessary for this work, and upon receipt of authority work on the runaway was commenced the following morning.

Summarizing the flight from McCook Field to Rockwell Field, a distance of 2,070 miles was covered in 24 hours, 31 minutes. The average ground speed was 83.7 miles per hour, the gasoline consumption 586 gallons, and the average fuel consumption per hour, approximately 24 gallons.

A Standard Liberty-12, 400 h. p., McCook Field, overhauled engine was used, with the following accessories:

- Modified Zenith Carburetor, Venturi Tube,
- 36 M. M. Metering Jets flow Main 39) pts. Comp. 95.5)
- Standard oil pump with oil radiator.
- Mosler M-I Spark Plugs.
- Delco 8 volt ignition with special 8 volt generator cut out and standard 8 volt regulator.
- Two 8 volt ignition batteries.
- Sylphon gasoline pump.
- The usual nose radiator with 3 expansion relief valve assisted by a booster radiator furnished adequate cooling.
- Four gallons extra water was carried in a nurse tank with means of injecting same to the intake side of the water pump.

Testing Anti-Aircraft Batteries

Lieuts. L. F. Post (pilot) and B. R. Dallas (observer) recently made a night flight in conjunction with a training problem of the anti-aircraft batteries at Fort Scott, San Francisco Bay, played tag between the many beams of the search lights, and appeared to be able to dodge the gunners on the ground at will. The night flights in the vicinity of San Francisco are much enjoyed by the populace in general as well as those at Crissy Field.

Transporting Airplane Engines by Plane

While returning from the Detroit races in General Patrick's new plane, Majors Dargue and Pirie experienced a forced landing in the vicinity of Buffalo, N. Y. A message was directed to the Aberdeen Proving Grounds, Md., requesting that a new motor be dispatched to Buffalo. Same arrived in less than 24 hours. The transporting of a Liberty motor over such a distance as this is not a common occurrence. The center section of a Mark 20 Bomb Rack was removed from an NBS-1, and the motor loaded in the fuselage. Taking off from Aberdeen at 9:30 in the morning, Lieuts. George and Bleakley flew to Buffalo and made the trip in about five hours, a stop for service being made at Middletown, Pa.

Border to Border Non-Stop Flight Postponed

Lieut. Leland S. Andrews, who had contemplated making a non-stop flight from the Mexican to the Canadian border in the plane piloted by Lieut. Doolittle on his recent transcontinental flight, was recently discharged from the Base Hospital at Fort Sam Houston, Texas. He is very much disappointed in having to postpone his border to border trip, but must bow to the will of the Flight Surgeon, who is of the opinion that Lt. Andrews' physical condition is not such as to warrant his making the attempt just at this time.

The ever increasing value of aerial mapping work is forcefully brought to our attention each time a report is received covering such operations. The Engineering Division, McCook Field, Dayton, Ohio, has just submitted a report covering the operations of a photographic mapping expedition to the State of Tennessee, which was directed by Captain A. W. Stevens of the Aerial Photographic Branch of the Engineering Division, with Lieut. George W. Polk as pilot.

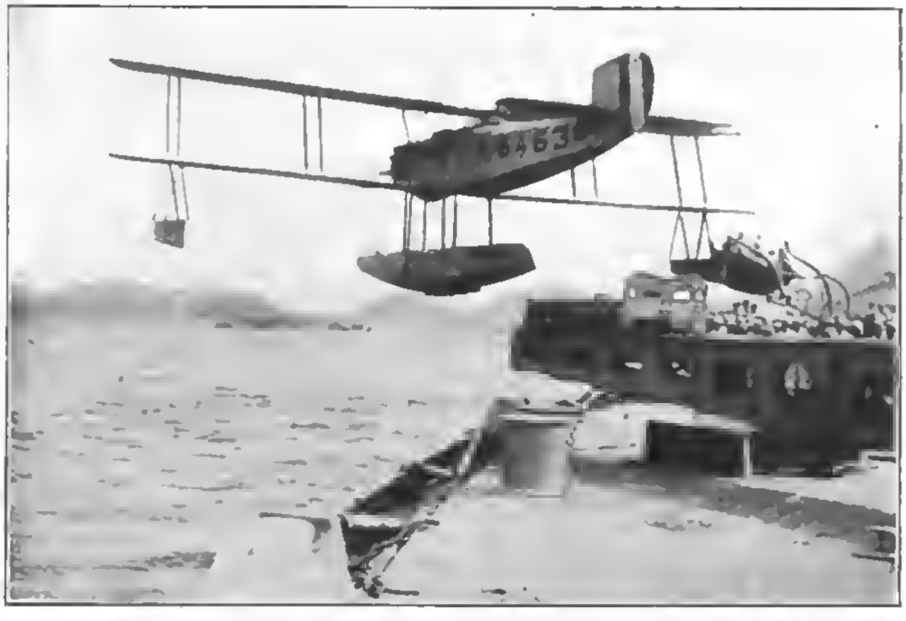
During the course of two months Captain Stevens exposed, developed, numbered, plotted, and printed negatives covering 5,000 square miles of the State. A flying field was selected near Tiptonville, Tennessee, and a laboratory set up in the village. From this point as a base, photographic work was carried out in the northwestern, southwestern, and central parts of the State.

The region known as the Reelfoot Lake area, which comprises 630 square miles and extends from the foothills on the east to and including the Mississippi River on the west, was photographed first. Two photographs were made of it, one from an altitude of 15,000 feet with a K-1 camera fitted with a 12-inch lens. The other was made from an altitude of 16,000 feet with a Tri-Lens camera, using 6½ and 7½-inch lenses. Ammonized panchromatic film was used entirely, with ray filters which excluded blue rays altogether and thereby eliminated the effects of aerial haze.

An area of 1300 miles, embracing the Mississippi River from New Madrid, Missouri, south to the Tennessee-Mississippi State Line, was next flown over and photographed, the F-1 camera being used.

The third area was that of the Memphis Quadrangle, which was photographed twice from an altitude of 16,000 feet. The T-1 camera was used in making the first photograph, and the K-3 camera in making the second.

(Concluded on page 37)



The latest in Naval Aviation demonstrated at Rio de Janeiro at the Brazilian Exposition. Seaplane being launched from the U. S. S. Navada

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UNIFIED AIR SERVICE PROPOSED IN ITALY

General G. Douhet, who is in a position corresponding to our Chief of Staff, is urging the creation of a Central Air Bureau, headed by a civilian.

Under his plan, the War and Navy departments will still have the responsibility of the employment of the Army and Navy air services, which are integral parts of the Army and Navy and provided for in the respective appropriations, the Army and Navy to determine the quality and quantity of aircraft and equipment necessary and to assume responsibility for its employment.

To this extent, the Air Department is limited in its functions to merely a supply organization for material and personnel against reimbursement of expense. The Air Department also bears the same relation to any other department which may use aircraft.

This Central Aeronautical Bureau will have direct supervision of civil aeronautics and of the Independent Air Force, which can act independently from the Army and Navy.

In fixing the appropriation for the C. A. B., sums will be set aside for the development of civil aeronautics and for the creation and development of the Independent Air Force, the third branch of the national defense power.

In operation, the C. A. B. would have two main divisions, the one charged with the supply, from private industry, of all the materials of the quality and quantity needed by the various departments and by the I. A. F.; and the other charged with the supply, from private initiative, of trained personnel, according to the requirements of the various departments and by the I. A. F.

It is planned that the Government do away with all that does not belong to it or else entrust it to private concerns, leaving freedom for private initiative. The proponents believe this organization can operate with the minimum of offices, officials and paper work.

New "Air" Members in the Commons

Many candidates who have been elected to the new British Parliament are, or have been, interested or closely associated with aviation—amongst these we notice, and welcome back to his seat, Sir William Joynson-Hicks; also Lieut.-Col. J. T. C. Moore-Brabazon, Admiral M. F. Sueter, and Maj.-Gen. Sir F. Sykes. Possibly a good omen for the future of air matters is the fact that Sir Samuel Hoare, Minister for Air was the first Minister returned whilst Sir J. L. Baird, who was a member of the Air Board for the Royal Air Force, appropriately as an air supporter, represents "Ayr" in the House, and it may be noted for this same constituency the labour candidate, who was defeated, was named Airlie. Many other supporters and well-wishers of aviation are welcome members, including: Capt. W. Brass, a distinguished R.A.F. officer; Comdr. Burney of Imperial Airship fame; Capt. Wedgewood Benn; Rt. Hon. Lord Hugh Cecil (R.F.C. 1915); Capt. A.G. Reid, R.A.F., D.F.C., Capt. D. Shipwright (R. F. C. 1916); Sir John Simon (R. F. C. 1915-16); Maj. G. C. Tyron (Under Secretary for Air, 1919), etc.

India's Air Command

As the result of Air Vice-Marshall Salmond's visit to India, the air command in India has been raised to the dignity of an Air Vice-Marshal's command. Air Vice-Marshal P. W. Game has been appointed to the post in the place of the present commander, Air-Commodore Tom I. Webb-Bowen, air officer commanding R.A.F. in India. The headquarters of the Indian Air establishment will be transferred from Umballa to Delhi.

Pilotless Plane Safe from Enemy Control

Pilotless bomb-carrying airplanes controlled by wireless will be the most dangerous weapon in future wars, says the French inventor of wireless instruments, Branly, who insists that French apparatus has been developed to such a point already that it is impossible for enemy wireless experts to interfere with control. Not only would an enemy be obliged to know every secret wave length used, but the French controls under experiment were so delicate that special and intricate signals could be so sent as to operate directly many small parts of mechanism.

"As a result," says Branly, "the enemy would have to have full knowledge of the mechanism used, and this can be changed every time the plane leaves the aerodrome; and stolen secret codes henceforth will be useless. Of course, parasite waves could be sent out in all directions, which might make our control more difficult, but under such conditions the enemy would be interfering with his own wireless also."

Commercial Airplane Flies 100,000 Miles

When the Daimler air express G-Ebbs arrived in London from Manchester a few days ago it achieved a new commercial aviation distance record, having completed 100,000 miles of flying.

The machine is the first airplane to fly this distance. During its long career the machine carried thousands of passengers. At present it is working on the Manchester-London-Berlin route.

Imperial Air Mail Survey

The civil Aviation Advisory Board of the British Air Ministry in July 1922 submitted to Parliament a complete survey on Imperial air mail services and their possibilities. It is proposed to have several services linking up an air line to India, by means of privately operated companies sufficiently subsidized to insure a small percentage on capital invested.

International Aero Exhibition and Contests at Gothanburg, Sweden

We have received requests from officials of the Gothenburg exhibition for co-operation in securing representation of aerial products from the United States.

The Exhibition will open at 12 o'clock noon on Friday, July 20th and close on Sunday, August 12th, 1923. The Exhibition grounds will be open from 10 a. m. to 8 p.m. daily and all articles exhibited must remain on view during these hours. The Exhibition will be held in Gothenburg on the open space known as Exercisheden, which has an area of 120,000 sq. metres and, in addition to a number of smaller buildings, a large Exhibition Hall will be erected with a floor space of 9,650 sq. metres.

The rates for space for respective groups are:

In American currency and measure approximately calculated with an average rate of exchange: $1 =3,00 Swed. Kronor.

for group	A to C	..about	.54pr. sq. ft.
" "	F to K	.. "	.98 " " "
" "	D to E	.. "	$1.22 " " "

Offices: 61c pr. sq. foot.

N.B. All payments shall be effected in Swedish currency.

Definite applications for space must be in the hands of the Board on or before January 1st, 1923. Applications must be made upon a prescribed form, in accordance with the regulations issued by the Board and shall contain a full description of the proposed exhibit, and no alterations shall be made in respect of the object or objects exhibited without the permission of the Board. The Board reserves to itself the right to refuse any application. Copies of the program may be obtained from the Aeronautical Chamber of America. For detailed information communicate with Mr. Thorsten Gerle, Director General of Posts, Stockholm, Sweden.

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Modification of Government Subsidy to British Air Lines

The British Air Ministry, with the concurrence of the Lords Commissioners of His Majesty's Treasury, has decided to modify the system under which subsidies are at present granted to approved firms for the operation of the Cross-Channel routes.

Three approved British companies—Handley Page Transport, Ltd.; Instone Air Line; and Daimler Hire, Ltd.—have operated services under the existing system which provided for the grant of a subsidy of 25% on an "approved" firm's gross earnings and additional payments per passenger carried and per pound of goods and mails transported, as well as certain contributions towards the provision and insurance of aircraft, subject to the fact that the total contribution either in cash or in kind should not exceed £200,000 per annum. Each of these firms was authorized to run London-Paris services and the Instone Air Line also received approval to inaugurate a London-Brussels service. In addition, a company in formation by the Supermarine Aviation Works, Ltd., was approved for operation of the Southampton, Cherbourg and Channel Islands route, but this service has not yet been opened.

It has now been found that the total payments under the subsidy scheme are insufficient to provide the companies with the necessary measure of financial assistance, and for some time past alternative proposals have been under consideration. An analysis of the situation showed that the volume of traffic, both on the London-Paris route and the London-Brussels route, has not been forthcoming to the extent which had been anticipated on the evidence of previous years' operations, despite the fact that British companies have secured on the London-Paris route the greater proportion of all classes of traffic.

The new scheme provides for the elimination of the present competition between British firms by the allocation of a separate route to each company. The basis on which the subsidy (which is still limited to the sum of £200,000 per annum) will be given is a limited cash payment for the completion of a stipulated number of flights and a contribution in cash or in kind towards the maintenance of a fleet of approved size and value. The routes to be operated under the new scheme will be:

London-Paris by Handley Page Transport Ltd.

London-Brussels-Cologne by Instone Air Line.

London-Amsterdam-Bremen-Berlin by the Daimler Hire Ltd. (subject to further negotiation).

Southampton-Cherbourg and Channel Islands by a new company. (not to be opened till next spring).

The approximate lengths of the different routes are London-Paris 225 miles; London-Brussels-Cologne, 310 miles; London-Berlin, 570 miles; and Southampton-Cherbourg-Channel Islands, 120 miles. The number of routes operated and the mileage flown by British firms will therefore be greatly increased.

Flying Fire Fighters

Manitoba is the first province in Canada to rely solely upon the flying service for the protection of its forests, says Consul General Brittain, Winnipeg, in a report received by the Department of Commerce. One 10-passenger flying boat has been dispatched to The Pas, about 350 miles northwest of Winnipeg, and it will shortly be joined by three others. Four additional machines will eventually be stationed at Victoria Beach, on the eastern shore of Victoria Lake.

Besides patrolling the forests of the province and adjoining territory, the flying boats will be used for conveying agents of the Dominion Indian Department and survey parties to their posts. It is also the intention of officials to carry mail and make aerial photographs of the country from the aeroplanes.

Aviator Poet

Everybody is likely to be interested in the new edition of Jimmy Howcroft's poems, which, under the title "LOOKING ON" is now issued by the author.

Howcroft is an Airman who was desperately wounded during the war. Since 1916 he has been unable to move hand or foot; indeed it is a mystery to his doctors that he should be able to live since his spine is fractured. He is in constant pain.

Howcroft, however, has the poet's ability to rise superior to his surroundings, and most of the poems in this little volume were dictated to his nurse in The London Hospital where he was looked after for five years.

Howcroft now lives at Liphook, in a cottage, in comfort, largely owing to the tangible result of the first edition of this book. With his wonderful enthusiasm he is now very keen on starting a poultry farm, and he is looking to future sales to start him in this scheme.

These verses serve to show us there are no circumstances, however adverse, which a courageous spirit may not surmount. There must be many who, admiring this war hero's sustained courage, will be glad to help in the small way of securing this little book of poems, which has proved itself of help to many on account of its outlook of cheerfulness and courage. This second edition much augmented, revised, and a new photograph added, can be obtained from the author at Little Forest Cottage, Liphook, Hants; at the low price of 2/6d. post free or by the kindness of Messrs. Eden Fisher & Co. Ltd., from them at 95 Fenchurch Street, E.C.3.

The Field Lighting System at Le Bourget

Air travelers from London and Continental points locate the aerodrome at Le Bourget by Barbier & Besnard electric searchlight with shutters. This has a range of 120 miles, lighting all the azimuths from the horizon to the zenith. The light signals the Morse "N" (—.) every eight seconds. The light is mounted on a *pylon* about 98 feet high.

The direction from which the wind is blowing in indicated by a luminous "T" wind vane. The airplane alights parallel to the long axis of the "T".

A circle of 82 feet diameter, formed in colored electric lights, illuminated either in green or red as desired. This serves to indicate the direction in which to land according to the rules of the field. Green signifies "Turn to the right;" red says "Turn to the left." Finally, a Greek cross is illuminated to allow or refuse landing. Red advises "Do not land"; green indicates "Authorization to land."

Obstacles are all indicated by red lights. Four large beacons which, during the day, indicate the limits of the field, carry at night powerful red lights. The buildings as well as the radio poles and searchlight pylon are indicated by columns of red lights. The landing field, therefore, appears as a dark spot framed by a series of red lights. Unexpected obstacles on the ground, such as damaged aircraft or vehicles, are surrounded with red lights.

When the airplane has been given the word to alight, there is lighted a group of B. & N. projectors carried on a truck to the most convenient part of the ground, according to the wind direction. These projectors light the ground horizontally over an approximately rectangular area. The intensity of the light is such that one can easily read a newspaper on a dark night a thousand feet or more from the truck. The group of lights is so placed that the pilot landing in the wind is lighted from the side.

To further avoid any misunderstanding as to the direction in which to land, a row of white lamps 60 feet long placed in the direction of the wind, is run from the truck which is itself indicated by a red light. The pilot must alight parallel to this row of lights, from the first white light toward the red light.

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Navy's Giant Airship Design Approved

Experts of National Advisory Committee for Aeronautics Give ZR-1 "OK"

ALL elements of design and construction of the Navy's Fleet Airship No. 1, better known as the ZR-1, have been approved by a special committee of engineers and experts appointed by the National Advisory Committee for Aeronautics at the request of the Naval Bureau of Aeronautics. Work of assembly, now well under way, will be completed by July 1, 1923, it is now estimated by the Naval constructors.

It is agreed by the committee members that all available airship information has been applied in the ZR-1 designs and that the Naval engineers have used good judgment throughout. The basing of the fundamental design on the successful German Zeppelin L-49 has also found favor in the eyes of the investigators, who not only checked the plans and specifications but have tested the materials used and 200 full-sized girders for strength. Carefully outlined and detailed tests of the 680-foot airship upon her completion, as provided by the Naval engineers, have also been endorsed by the National Advisory Committee for Aeronautics as a safety precaution.

The Special ZR-1 Committee

Dr. Henry Goldmark, a well-known consulting engineer of New York, heads the special committee, which includes the following engineering and aeronautical experts: Prof. William Hovgaard of Boston, director of warship design at Massachusetts Institute of Technology, and internationally recognized as the foremost authority on the structural strength of ships; Dr. L. B. Tuckerman, physicist of the Bureau of Standards; Dr. Max M. Munk, aeronautical expert of the National Advisory Committee for Aeronautics, and Prof. W. Watters Pagon of the Civil Engineering Department of Johns Hopkins University, Baltimore, Md. For practically five months since its first meeting in June, which was called to order by Rear Admiral D. W. Taylor, U. S. N., the committee has been studying and checking the plans of the airship holding in all fifteen full meetings.

The Navy's Airship

Briefly the specifications for the Naval Airship call for a rigid craft built of duralumin trusses and girders, containing twenty separate gas bags totaling 2,155,200 cubic feet, and covered with a single envelope. Her total length is 680 feet and her diameter is 78 feet. Six separate cars are suspended from her keel each carrying a 300 HP Packard aircraft engine.

The rigid airship selected as a prototype for the ZR-1, the L-49, embodies the experience obtained in the construction and operation of 100 successful airships through a period of ten years, the report states. Calculations for the Navy's aircraft were fuller and made in greater detail than any specifications for similar craft on record, the committee reports, explaining that its own conclusions were reached after studying all elements of ZR-1's design and construction. A special study of methods used in computing the stresses and aerodynamic forces acting on the craft in flight were gone into and the committee is of the opinion that the methods followed in the ZR-1 designs are sufficiently accurate.

Only One Airship Failure

A study of the records of rigid airships built in the past, revealed the fact that the only known case of a disastrous accident due to structural failure in flight was that of the British airship R-38, also known as the "ZR-2", although the reasons for the failure have not, in the opinion of the committee, been definitely determined. Although the structural designs were not similar, the committee compared the plans of the ZR-1 with those of the R-38 from every point of view and finds that the ZR-1 is "measurably stronger". Possible causes for failure of rigid airships other than structural weaknesses were considered by the committee in its investigations with the result that the members feel that careful provision in the design of the Navy's airship has been made to guard against them.

Although the ZR-1 which is being constructed at Lakehurst, N. J. will probably be structurally complete by the end of the fiscal year, Naval experts say that progress from that day on will be very slow, due to the many tests and experiments to be conducted before she takes the air. All the twenty gas-containers, for example, must be tested for leakage and lift. In fact every part must be individually tested before the first trial flights with instruments to record all pressures that are made. The prescribed program of scientific tests and trials will be rigidly followed before the great craft of the air goes into active service, and this the committee believes will furnish great additional assurance of successful service. This was the purpose of Admiral Moffet, Chief of the Naval Bureau of Aeronautics, in asking the National Advisory Committee to undertake the checking of the Navy's plans in detail, he did not want a repetition of the disaster which occurred during the tests of the R-38, which was to have become the United States Navy's first large airship.

Air Industry To Pay Tribute on Basic Radio Patent

ANOTHER pioneer in the aircraft development is to receive his reward for invention. As commercial flying comes to pass and inter-city aircraft routes are inaugurated, radio equipment will be an immediate necessity.

If the Government has made no mistake in accepting his invention as basic and in paying $75,000 for a license, commercial users will likewise recompense Harry M. Horton, whom many early birds will remember for his first public demonstration of radio sending from an aircraft in flight.

"Another chapter, in aerial achievement is recorded in the sending of this wireless message from an aeroplane in flight" was the message broadcasted by John A. D. McCurdy from his 4-cylinder Curtiss pusher at the Sheepshead Bay meet in August, 1910.

The sending apparatus was secured in the machine just behind the pilot's seat and it weighed about 25 pounds. It was designed by Mr. Horton, previously an expert with the De Forest Company. When the trial was ahout to be made, McCurdy was handed this message by F. D. Caruthers, of the *World*. It was received by an outfit placed in the grandstand.

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The telegraphic key was fastened to the steering wheel. For a ground wire, there was used one about 50 feet long, which was thrown over and allowed to dangle below the machine. The antenna consisted of the guy wiring of the machine.

Government Obtains License

The payment by the Government of $75,000 for a license under the Horton payment, after investigation of his claims to priority and scope, has just come to light through *Aerial Age*. Although extensive use was made of radio from 'planes during the war, in experiment, school work and in artillery adjustment, Mr. Horton asked no recompense. One should say, "Captain" Horton, for he was in the Army Air Service and is an accomplished pilot from prewar days. To this extent, the patent is already adjudicated and it is not anticipated that infringement suits are probable in the future.

Development of Aircraft Radio

In the Fall of 1909, Captain Horton saw his first flight on the Mineola plains. He visualized the future need for a method of sending information to the rear the instant it was obtained.

In an aircraft there seemed to be no place for an antenna or radiating wires and no ground to balance the current. Weight was also to be considered. It was realized an entirely new radio set would have to be designed.

Experiments had been made in previous years with hanging wires as antennae but there was a ground. Messages were received in balloons. Lieut. F. P. Lahm, Maj. Edgar Russel and Capt. C. S. Wallace of the Signal Corps made a balloon ascent in 1908 and successfully received, marking the first experiments of the Army. Horton lined his balloon basket with tin foil to get capacity.

Beginning his work with the airplane, Horton found he could generate the energy but could not get the signals away from the 'plane.

"Why not use the stay wires of the airplane itself for capacity," was the question that suddenly came to mind, throwing overboard a hanging wire as an antenna with its upper end in electrical contact with one side of the apparatus.

And this worked, after every other possible Hook-up had been tried.

Although successful from a radio standpoint, the aviator received severe shocks each time the transmitter was operated, if, by any chance, he came into contact with any metal parts of the machine. A way was finally worked out to make all of the stays in the machine, the engine, tanks and all metal parts, act as a part of the oscillating system. The steering wheel being connected thereto and uninsulated and being firmly grasped in his hands, the oscillations were actually passing through his body each time the transmitter was operated, but inasmuch as the other side of the oscillating system was carefully insulated he experienced no ill effects.

The sending outfit used at Sheepshead Bay consisted of a small, compact storage battery that had an actual ampere-hour capacity of 60 and a voltage of six, a high frequency coil that weighed twelve pounds, a helix with two small condenser tubes mounted in parallel, and the transmitting key. The whole weighed thirty pounds.

Following this public demonstration, the first in the world, McCurdy and Horton continued trials at Hammondsport. Thus it was that the military necessity of the present was anticipated by many years. Four years later the English and French were adjusting artillery on the Western Front with radio.

Today all armies and navies use aircraft radio for a variety of purposes. We speak from plane to earth and vice versa. A squadron commander communicates to other planes in flight, formations are flown at voice command from anywhere, mail 'planes are guided through fog by directional radio, the forest patrol spots fires and blowdowns, the transatlantic airship is in touch with ships or shore, the Secretary of War has spoken from Washington with a pilot flying above March Field in California. The method has not changed in principle, however, from 1909.

(Concluded from page 33)

The expedition then photographed the Nashville 30-minute Quadrangle, which embraces four times the area of the 15-minute Quadrangle, or nearly 950 square miles. It also covered 480 square miles of the valley of the Cumberland River, and 180 square miles of the valley of the Harpeth River. It is interesting to note that in two successive days, September 30, and October 1, the 1610 square miles were covered.

On October 1, 1010 square miles were covered in four hours, 50 minutes flying time, with the T-1 camera, from an elevation of 16,000 feet. At this elevation the width of the country covered in one strip by the camera is ten miles. Although the weather was extremely hazy, (the visibility being only 8 miles) there was no difficulty in cutting the haze for a distance of 5 miles each side of the airplane with the film and filters described above.

The Reelfoot Lake area is particularly interesting from the standpoint of a geologist, as the lake was formed in 1812 by one of the greatest earthquakes of modern times. If such an earthquake were to occur today, it is estimated that ten times the damage of the San Francisco quake might be inflicted. In the early days of the country the region was sparsely populated, but now there are many towns that might suffer total destruction were such a disaster to happen again. The whole lake region is low and marshy, and a survey of it on the ground would be both difficult and expensive; for these reasons it was decided to cover it by photographs made from the air. The U. S. Geological Survey now has these photographs in its possession, and from them is completing the map of the Reelfoot Quadrangle. No map whatever was available for use as a flying map, consequently the strips had to be flown without a map. After the area was covered by one camera, a sketch map was prepared on a reduced scale, and this sketch map was used as a flight map when covering the area again with the Tri-Lens camera. This sketch map proved the length of the lake to be approximately 10 miles; Rand-McNally maps and others show the lake anywhere from 30 to 100 miles long, and of quite different shapes.

The results of this expedition, together with those of the New Hampshire expedition of last year, which was also directed by Captain Stevens, demonstrate that aerial photographic work is best done at about 16,000 feet with the DeHavilland airplane, as this altitude can be gained in about 50 minutes, and the air is still dense enough to allow good control of the airplane.

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Swanson Biplane

Following is a description of a small sport plane constructed by S. Swanson, of Vermillion, South Dakota.

Wings

The webs of the ribs are Bass wood with the usual lightening holes, cap strips are of spruce. Spars are of the routed I beam section also of spruce and spliced in the center so that they are continuous spars thru the whole span of the wing with a dihedral of four degrees, both planes are built in one continuous panel from tip to tip.

The upper plane has a cut-a-way at the center over the cockpit and is fastened to the center N struts with four bolts. The lower plane which is a single panel is fastened to under side of fuselage with three bolts. The ailerons are on lower plane only, and aileron control wires run within the lower wing.

The single I struts on each side for inter plane bracing are of built-up spruce laminations. Landing wires and single flying wires are double, all are 3/32" cable.

Fuselage

The fuselage is of the girder type built of spruce, the longerons being of ash forward of cockpit, the cockpit is roomy with plenty leg room for such a small machine. The rear end of fuselage tapers off into a horizontal wedge and the whole being nicely streamlined with basswood false work. The cowling is of 20 ga. aluminum, a three hour duration gas tank is located between the fuselage and cowling just over the center of gravity. The engine is separated from the fuselage by an aluminum wall.

Tailplane

The fixed horizontal tailplane is built into the fuselage and has one third of its camber on the lower surface and two thirds on the upper surface, the elevators have a negative rake of 20 degrees. The tailbeam to which are hinged the elevators, is a continuous beam of six ft. span which is also stern post of fuselage and has no external bracing. The rudder fin is also built into the fuselage and projects thru on lower side so that there is a small vertical fin disposed on the under side, to which is attached the tailskid which is of ash sprong by the usual rubber shock absorbed cord, all control flaps have a special hinge construction which leave no gap between surfaces namely a round leading edge of the flaps which fit into a round groove to the fin side, similar to the German Albatross plane hinge, thus ensuring a smooth and even flow of the air over the surfaces. All control surfaces are negatively raked except top edge of rudder. There is no external bracing on the tailplane whatever, all control-horns are built into the various flaps.

Great simplicity in assembling is obtained for all that has to be done is to fasten lower wing under fuselage and upper wing to N struts and insert the interplane struts, and tighten wires.

Two Views of the Swanson Biplane

Controls

Standard stick and foot bar controls are used and so arranged that large movements of the stick produce but small movements of the various flaps.

Landing Gear

The under-carriage is of the Vee type with a split axle hinged nine inches on each side of center, the struts are of stream-lined section ash. Wheels are 24" X2" sprung by the usual rubber shock absorbers, while the track is 4½ ft. wide.

Power Plant

An aircooled 2 cyl. opposed Lawrence 28 H. P. motor is used and is left uncovered where it is amply cooled, the carburetor is also outside of the fuselage where the risk of fire is decreased.

The propeller also designed and constructed by me is 5½ feet pitch and diameter of 5½ ft. which the engine turns at 1500 R.P.M.

Following is the general specification of the plane.

Span both wings	18' 9"
Chord both wings	34"
Gap between wings	40"
Stagger	14"
Length over all	15'
Height over all	5' 7"
Wing curve	U.S.A. 15.
Total wing area	100 sq. ft.
Angle of incidence top wing	3½°
Angle of incidence bottom wing	2°
Decalage	1½°

(*Concluded on Page 43*)

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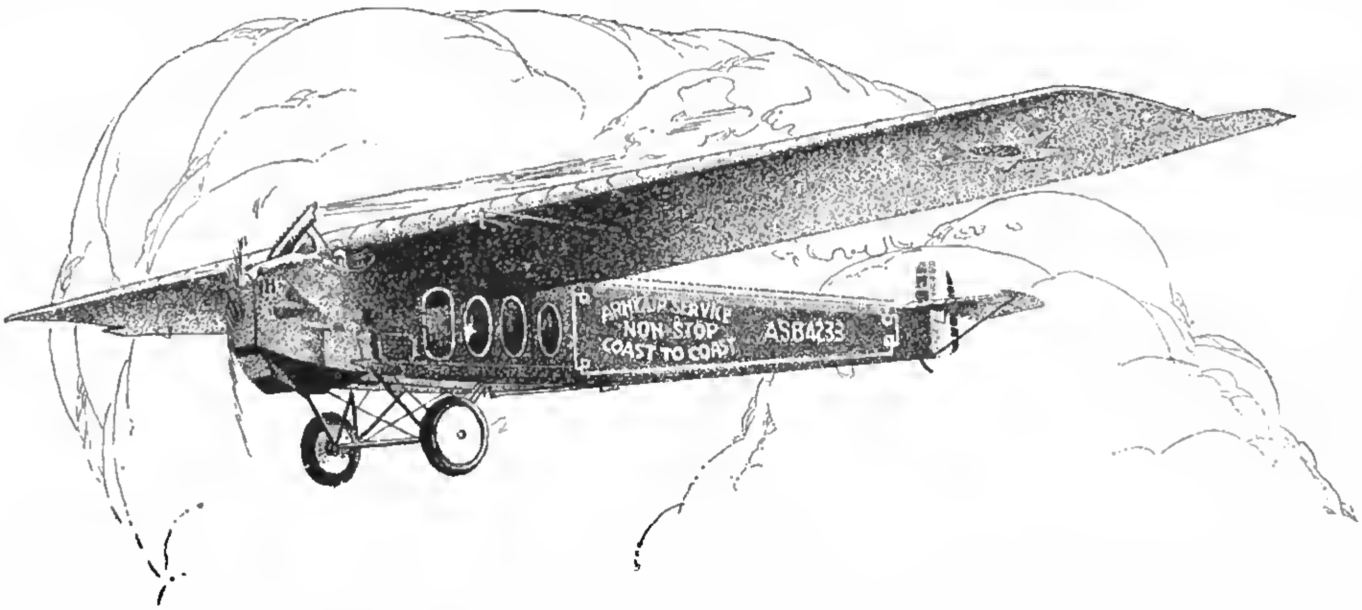

A Superb Effort and a Record!

On the morning of November 3rd, the giant Army-Fokker Monoplane T2 took off from Rockwell Field at San Diego. The Atlantic Seaboard was her goal.

Two hours later a water-jacket cracked—Old Man Luck had taken a hand. But Lieutenants John A. Macready and Oakley G. Kelly determined to push on.

For more than twenty-four hours they fought against terrific odds. As the water leaked out, canned soup, milk, and coffee were poured into the radiator.

Early next morning the engine became so hot that the plane threatened to catch fire. To push on was suicide. So, at 9:50 A. M., the T2 landed at Schoen Field, Indiana, her engine burned out.

A superb effort! And in making this effort the T2 broke all previous records for a non-stop flight—2060 miles were covered in 27 hr. 56 min.

We count it an honor that the T2 was Valsparred.

FOKKER AIRCRAFT

Valentine & Co.
364 Manhattan Ave.
Brooklyn, N. Y.

November 17, 1922

Gentlemen:

In reply to your inquiry we wish to say that we have found Valspar to be in every respect excellent. It is used on practically all of the Fokker commercial aeroplanes which are in use on the European air lines. The machines which we have flown in this country have been exposed to extremely unfavorable weather conditions in the open, but we have found that the veneer covered wings with an extra coat of Valspar are entirely unaffected, even when they have been covered with snow for several weeks.

It is evident that our factory in Holland thinks the same of Valspar as we do here as, with some of the machines that came over, they even sent some cans of it for use here.

The Fokker F4 monoplane with which the United States Army Air Service recently made a World's Duration Record Flight of 35 hours 18 minutes at San Diego, and later made a record non-stop flight under extremely bad weather conditions from San Diego to Indianapolis in 25 hours, was also finished with Valspar.

Very truly yours,

RN: HM NETHERLANDS AIRCRAFT MFG. CO.

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VALSPAR

The Varnish That Won't Turn White

VALENTINE & COMPANY

Largest Manufacturers of High-grade Varnishes in the World

ESTABLISHED 1832

New York Chicago Boston Toronto
London Paris Amsterdam

W. P. FULLER & Co., Pacific Coast

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(*Concluded from Page 19*)

ful searchlight, arranged so that its rays point directly upwards, will be sufficient. Quite some varied equipment has been, and is being, tried out and much could be written on this end of the subject, but any attempt to cover it completely here would require more space than can be given in this article.

Tables:

1. Complete list of air station maintenance and general equipment with some approximate costs.
2. Complete list of air station servicing equipment with some approximate costs.
3. Complete list of air station operating equipment with some approximate costs.

Illustrations:

1. Oil and gasoline barrel rack.
2. 5-gallon safety gasoline or oil can. (McNutt)
3. Oil and water heating system.
4. Tail skid towing and handling dolly.
5. Wheel chock.
6. Flying boat (HS-2-L) handling truck for hard surfaced runways.
7. Odier portable (compressed air) engine starter.
8. Wind cone.
9. Aldis landing signalling light.
10. Floodlight battery for night landings.
11. Pintsch landing ground-light system.

Table 1—Complete list of air station maintenance and general equipment (with some approximate costs as of August, 1922.)

Hand fire extinguishers.
$10.00 to $30.00 less discount of 10% to 33% according to type and quantity.

Fire engine.
40-gal., foam, $350.00. 80-gal., foam $1100.00. 70-gal., soda-and-acid $900.00

Fire gong or siren.
10" signal gong, hand operated, $5.00.

Heating system.
Variable.

Electric power unit. (where necessary)
Range from $250.00 for 300-watt set to $1395.00 for 2½-kilowatt set.

- Tractor with flat wheels.
Fordson with special wheels, $588.00.

- Grass cutter attachment.
$120.00.

- Road drag attachment.
$91.50.

- Snow plow or broom.
Rotary broom attachment, $400.00.

- Roller attachment.
24" diam. x 6'-0" long, $170.00.

Light truck.
Ford with stake body and cab, $665.00.

Desk, chairs, files, typewriter and miscellaneous office furniture.
Variable.

Automobile jack and garage small tools.
Variable.

-Indicates required for land stations only.

Table 2—Complete list of air station servicing equipment (with some approximate costs as of August, 1922)

Gasoline storage tank with measuring pump.
550-gal., system $200.00 to $310.00 installed. 10,500-gal., system $900.00 installed.

Oil barrel rack or tank and pump.
2-drum rack about $15.00 to $20.00.

Portable oil tank with measuring pump.
65-gallon, one compartment, $150.00.
65-gallon, two compartment, $215.00.

Safety gasoline and oil can.
5 gallon cans, $5.00 to $7.50.

Self-closing waste can.
From $3.25 for 12"x15" to $14.00 for 24"x36".

Water storage system. (where no running supply)
Cost very variable. For small supply, portable, 50-gal., steel barrels $10.00 up.

Tire pump.
Automobile hand or foot type $2.50 to $5.00.

Oil and water heater.
Makeshift system, $40.00 to $70.00.
Complete system, $200.00 to $225.00.

Battery charging set.
Improvised set using existing power supply and resistances, about $10.00 up.

Clothes and tool lockers.
Built at station.

Tarpaulin covers.
Variable.

Towing and mooring ropes.
½" $2.50, ¾" $5.00, 1" $8.00 per 100 ft., manilla.

- Handling dolly.
Varies with materials on hand. Possibly $35.00 to $50.00.

- Mooring rings or stakes.
Nominal.

- Engine starter.
No quotations.

- Wheel chocks.
$10.00 to $15.00 per set of two.

* Handling truck
Average size probably $40.00 to $50.00.

* Mooring buoys.
Small galv. iron $5.00, cork $10.00 to $15.00.

* Anchors.
Small, $5.00 to $20.00.

* Beaching tracks or runway.
Variable.

* Crab, capstain, or crawler tractor for hauling out.
Crabs, $68.00 to $128.00 according to capacity. Small winches, $20.00 to $25.00.

* Small power boat with service gasoline tank, etc.
Subject to great variation. 30-ft., boat with 12-h.p. engine probably about $800.00. Second-hand, about $400.00 up.

- Indicates required for land station only.

* Indicates required for water station only.

Table 3—Complete list of air station operating equipment (with some approximate costs as of August, 1922)

Wind cone or automatic Tee.
Wind cone $15.00 to $20.00 without mast.

Signal tower or platform.
Variable.

Megaphone.
Hand type $1.50 up.

Signal flags or semaphore.
Plain hand flags $1.00 each up. Semaphore variable.

Signal lights or flares.
10-min. red ground flares $3.00 dozen.
1-min. high power white flares $1.00 each.

Radio telephone or telegraph.
Very variable. Complete inside and outside apparatus, 50-100 miles telephone range, $4390.00. Same for 150-300 miles telephone range, $5540.00. Telegraph range about three times the above.

Landing floodlights.
Variable.

Landing ground-lights.
Variable.

Obstacle lights.
Variable.

Beacon lights.
Variable.

Rain gauge.
Jar type, $6.50. Self-measuring type, $40.00.

Anemometer.
High or low speed, $50.00. (Both probably required.)

Barograph or barometer.
Barograph, $45.00 to $60.00. Barometer, $20.00 up.

Thermograph or thermometer.
Thermograph, $55.00. Thermometer, $10.00 up.

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International Aero Exhibition
Gothenburg, Sweden, 1923.

In connection with the

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ILUG.

Gothenburg.

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Great International Flying Contests for Aeroplanes and Flying Boats

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The Secretary, Aero Exhibition, postal and telegraphic address:
Ilug, Gothenburg, Sweden,

or to the

Royal Swedish Legation, Washington,
Swedish Consulate General, New York.

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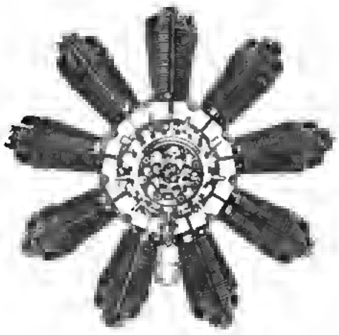

THE 400 H.P.

"Bristol"

Jupiter Radial Air-Cooled Engine

is the only aero engine in the world which has passed the Type Tests of both the British and French Air Ministries

BRITISH AIR MINISTRY TYPE Test, September, 1922

The Jupiter engine was the first air-cooled engine to pass this test, which comprised 50 hours' endurance test at 90 per cent. full power, one hour high speed, one hour high power, runs for power curve, etc. At the conclusion of these tests one hour was run at full throttle at 1,775 r.p.m., averaging 442 B.H.P., and one hour at 1,840 r.p.m., averaging 450 B.H.P.

FRENCH AIR MINISTRY TYPE Test, JUNE, 1922

The tests carried out at Gennevilliers included five non-stop runs of 10 hours each duration, the first half-hour of each period at full power, 9½ hours at 90 per cent. full power, with 2 minutes at full power at the close of each period. The average power recorded at the beginning of the periods was 413 B.H.P., and at the end 420 B.H.P.

The oil consumption was only 10⅛ pints per hour, and for the first time in the history of the French official tests the whole of the tests were carried out in 10-hour periods without adjustments or replacements of any kind.

The French Official Report States:—

"The 5 tests of 10 hours were carried out without stop of any sort.

"Nothing to report. The engine behaved itself perfectly. There were no replacements of any sort in the course of the trials.

"It is regrettable that this test stops at 50 hours; this duration could have been doubled, which would have been a still better testimony to the engine."

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The Air Mail an Economic Necessity

By Hon. Edward F. Taylor

Representative from Colorado, Member of the House Committee on Appropriations

UPON the subject of our airplane mail service our country has come to a parting of the ways. We must either stop or go forward. The only logical or sensible thing for Congress to do is either to discontinue the appropriation of $1,500,000 for carrying on the present service or appropriate $2,500,000 to extend and improve it.

"Without hardly an exception, I think all of the 35 members of the Committee on appropriations of the House are in favor of our going ahead and improving, developing and extending our air mail service by establishing night flying and demonstrating its entire practicability. The Postmaster General and the First and Second Assistants and Mr. Egge, the superintendent of the air mail service, and all the experts say that we have demonstrated fully and conclusively that daylight flying is a success, that daylight carrying of mail is a success, so far as carrying a limited amount of mail across the country is concerned. We do not need to spend any more money to demonstrate that.

"If we are not going to progress any there is no necessity of Congress continuing the present $1,500,000 annual appropriation—it was $1,900,000 last year—for the continuation of the air mail service that we are now operating every day in the year except Sundays and holidays from New York to San Francisco. But the fact is that just daylight flying does not expedite the mail enough to warrant the expense. We have got to develop night flying before airplane service will ever be of substantial value to the Postal Service or be either a financial or a commercial success.

"There is no place in the world where night flying is in operation at the present time. I believe the forward-looking people of this country hope that our Nation will go ahead and further develop airplane service by demonstrating that night flying is practicable. It is true, of course, that we do expedite a large amount of mail across the country every day.

"Here is the schedule of the 24 airplanes that are in the air every day. The West bound leaves New York City at 7 o'clock in the morning with 500 pounds of letter mail, and travels westward 225 miles to Bellefonte, Pa., by 10 a.m. Another airplane and another pilot leave Bellefonte at 10:15 a.m. and go on to Cleveland, Ohio, 210 miles by 1 p.m. Another pilot and plane leave Cleveland that morning at 9 a.m. and fly to Bryan, Ohio, 160 miles, by 10 a.m. and another plane leaves Bryan at 10:20 a.m. and flies 175 miles to Chicago, by 12:25, and so on from Chicago 195 miles to Iowa City, thence 230 miles to Omaha, thence to North Platte 245 miles, thence to Cheyenne, Wyo., 215 miles, and so on to San Francisco; 2,680 miles."

There is no continuous flight across the country. It is a relay, or rather, a succession of individual flights be-

Hon. Edward F. Taylor

tween certain cities. The outgoing usually leaves before the incoming plane arrives. But, roughly speaking, they do expedite or advance the mail approximately one business day right straight along across the continent. Approximately the same kind of a schedule is being carried out at the same time beginning at San Francisco and going east.

Each pilot makes only one of those flights a day, and then flies back over the same route next day with the same plane. He then rests one day and makes the same round trip the next two days.

That route is practically a straight line of 2,680 miles from New York to San Francisco. Adding up the relay flying time—that is the present schedule of the transcontinental trip—is 27½ hours. So we are perfectly safe in estimating that the day and night trip can be made in 28 to 30 hours. It probably will be made within 24 hours within the next five years.

There is no way at this time in which there can or will be developed a paying mail utility except by Uncle Sam. It is not at this time a paying proposition at all for any private enterprise to carry mail. But if we go ahead and they use the appropriation of $1,000,000 or $1,500,000 more, they promise absolutely to demonstrate within the next two years that night flying is entirely practicable. It is now proposed to establish a day and night route across the United States, starting from New York at any time up to noon, and flying to Chicago, and then a night route from Chicago to Cheyenne, Wyo., a distance of about 900 miles. The mail authorities want to make about 30 emergency landing stations on that route. The reason they select that central distance for the night route is, in the first place, that it is a straight line over a flat country. They have already got it pretty well marked out. In the second place, they can always start from New York and make Chicago in daylight, and then make this night flight to Cheyenne, and the next forenoon, any time up to noon, they can leave Cheyenne and land in San Francisco, and every day make the same kind of a flight from San Francisco to Cheyenne and a night flight to Chicago, and thence to New York. In other words, it will be a flight from 28 to 30 hours across the United States from east to west and west to east every day.

The Post Office officials and airplane experts feel quite confident they can establish and work the route for $800,000 if Congress allows them to use an unexpended balance they now have on hand, but to cover all contingencies they ask Congress for $1,000,000. That will expedite the mail by flying a distance of practically 900 miles. That is the air-line distance between Chicago and Cheyenne, which will be its night section, going both ways. That money will be expended principally in establishing stations.

Of course they must have emergency stations about every 25 or 30 miles and have them brilliantly lighted at night, so that they can be seen for, say, 30 miles, and large enough so that a pilot can safely land on them at any time any night. And then they will have a string of guide lights about 3½ miles apart, so there will be a continuous string of lights, automatic in operation, from Chicago to Cheyenne to

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guide them no matter how dark or foggy or stormy the weather may be.

For each of these emergency landing stations, it is contemplated to lease a field or a large square block of ground, at least an eighth of a mile wide and a quarter of a mile or more long, and surround each of them by brilliant beacon lights that can be readily seen for a distance of 30 miles or more and with ample space for the pilot to light safely in any kind of weather.

Those lights are about 70 feet above the ground and of a very intense white light; possibly some of them may be the so-called mercury vapor light. The lights will be automatic in operation. There will be 31 of these emergency fields between Chicago and Cheyenne. Those fields can be leased of farmers and equipped for approximately $15,000 each, and they will, of course, have the necessary local caretaker, and will only be used by the Aviator in case of emergency. Probably 25 out of the 31 will never be used.

The unexpended balance of 1923 will cut down this appropriation, so that, personally I do not believe there will be over $800,000 required to establish all these 25 or 30 stations, which will be permanent and to also erect this string of guide lights, some of them different colored lights, distinctive lights, but mostly white. There will also have to be some signals or instrument that will show the pilot how close he is to the ground at night. Also signals showing the directions and velocity of the wind, and probably some other night signals, especially for dark and stormy nights.

Now, if Congress will make this appropriation and establish that night route from Chicago to Cheyenne and develop a perfectly practical mail route of 28 hours between New York and San Francisco, each way, we believe it can be made a self-supporting proposition and that it will be taken up by other cities and throughout the country generally and that it will soon become a paying commercial enterprise. We hope and believe that airplane carrying of mail will before long be taken over by private concerns and that the Government will be able to let contracts for the carrying of mail by airplane on all practical routes throughout the country and to retire from the business after it has demonstrated that it is a complete success.

This last year, the Post Office Airplanes flew practically 2,000,000 miles without an accident, with a percentage of efficiency of 94.46 per cent. For 10 consecutive weeks this last summer its operation was 100 per cent perfect. Each trip across the continent was started regardless of weather conditions and finished on schedule time. It is universally acknowledged to be the best air-mail service in the world. About 12,000 pounds, or 480,000 letters are each day advanced practically one business day. Of course, between cities that are only 500 miles or less apart night air-mail service is not necessary or practical, because a night train will take all the mail there is put in the post offices up to 8 p.m. which is all of it, practically, and will deliver it in time to be distributed and delivered before office hours or in ample time for business the next morning.

This one transcontinental air-mail route is now carrying 2,380,000 pounds of letter mail each year at a cost of $2.50 per ton per mile.

There is only one man on each airplane. There are 40 aviators in this service now, and 24 of them are making a flight every day regardless of weather conditions, except Sundays and holidays. They are scheduled to fly 1,800,000 miles a year. There are supposed to be 75 planes in active commission. That is two planes in perfect order on the ground for each one in the air. At present there are 66 good planes in operation and about 30 being put in order.

The Post Office Department is doing very commendable and economical work in remodeling Army planes at a very reasonable cost. They are not the best kind of planes for this work, because there is not room in the fuselage or body of the airplane to carry more than about 600 or 700 pounds of mail. The Army planes are designed to carry bombs underneath. But the mail has got to be put inside the fuselage. Sooner or later there will be a different type of plane developed for the use of the Post Office Department that will carry several thousand pounds of mail and merchandise and some passengers. But at the present time, the Army has an unlimited number of Liberty motors on hand and the air mail service is using the Haviland Army planes that the Government now owns.

No human mind can grasp the future possibilities of the airplane. Our country cannot afford to lag behind any other nation in the world in this great enterprise with such marvelous possibilities. A strong merchant air fleet is as necessary to the national defense of the future as a strong navy or merchant marine. The status of commercial aviation in this country has a direct bearing on national defense.

Commercial aviation properly developed will form a reserve power back of the military and naval aviation forces. And our forward-looking citizens throughout the country are not only urging legislation toward developing the airplane service but also toward stabilizing commercial aviation. I see by a newspaper account of a report made by the Aeronautical Chamber of Commerce that the past year has been characterized by remarkable progress in design, construction, and operation. The report says:

> "Nowhere else has there been such startling improvements. American pilots in American machines, powered with American motors, have obtained such results as to warrant the assertion that there has been the most significant series of achievements in the world's history of flight."

I notice also that public-spirited business organizations are urging that Congress encourage improvements in a great many ways toward the further and more rapid development of airplane service. And they point with pride to the fact that the world's records have recently been made by American Aviators. They point to the fact that Lieut. John A. MacReady made the record altitude flight of 40,800 feet, and that he and Lieut. Oakley G. Kelly made the endurance record of 35 hours 18 minutes and 30 seconds in the air; and that those two men also made the long-distance record flight of 2,060 miles, while Lieut. R. L. Maughan made the speed record of 226 miles an hour. And, notwithstanding these superb records, of which we are all supremely proud, our Government is appropriating only about one-third of what either England or France are appropriating toward the development of aviation.

This is not a matter of dollars and cents. I am not appealing on that ground. Our committee appeals on the ground of patriotic national pride. We ask this small, but absolutely necessary appropriation in order that our Government may go ahead and demonstrate to the world that we can establish a thoroughly practical night-flying mail service, and to be the first nation in the world that does so. We ask this to encourage the hundreds of splendid young men who are striving every day to make this great service a great success.

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Present Day Aeronautical Problems

By Ralph W. Cram

Editor Davenport Iowa Democrat, Vice President and Governor National Aeronautic Association of U. S. A.

NOT so long ago, a friend of mine said to me. "When are we going to fly around in airplanes just as we ride around in automobiles today?" My answer to him, because of our age, was "*We* never will. But, without question within a short time we will go to Chicago or New Orleans or Salt Lake or San Francisco, also to Paris and London and Petrograd, not by train or steamship, but by airship."

And that is my earnest belief in the matter. I do not think that the time is yet at hand when the average person will own an airplane, but I am quite sure that an airplane or an airship, as the dirigibles are known in the parlance of the trade, will soon be available to all of us for long journeys, the craft carrying relatively large numbers of passengers, operated hy transportation companies, financed in a manner similar to the way our railroads are today.

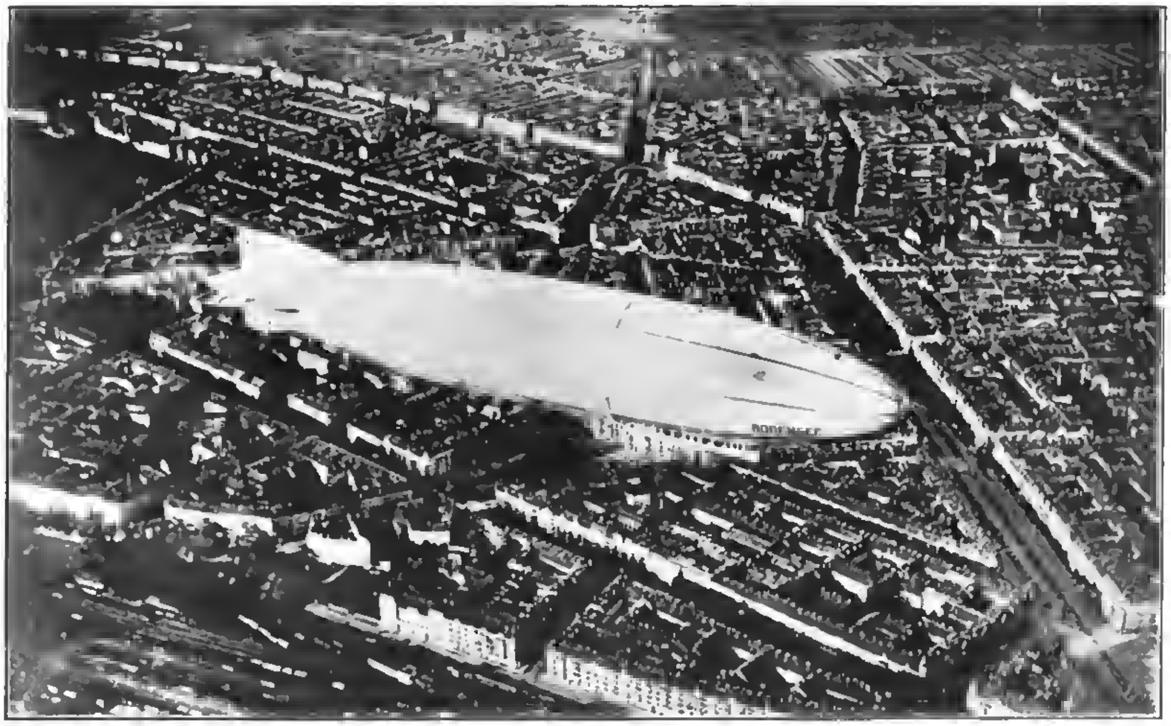
I proceeded to tell my friend that it was a dead loss of one whole day, to say nothing of physical discomfort, for him to go from New York to

Ralph W. Cram

Chicago by railroad train. I pointed out to him the advantages both financially and physically which would accrue to him if he were able to get in the state-room of a large airship around 9:00 o'clock in the evening, and after a cool and noiseless journey, arrive in Chicago about daybreak the next morning.

"It all sounds very well", said he, "but I must go by railroad as things stand today, and what I and millions of other persons in the United States are interested in knowing, is what can I do personally, as an individual, to hasten the day of that cool, comfortable, noiseless and speedy journey you talk about?"

I think his query is not only sensihle, but typical. There are millions of people in this country today who want to know what they individually can do to hasten the development of aeronautics. During the war, some 25,000 of our young men were in the Army or Navy flying corps. They learned the great advantage of flying, its great saving of time, and they communicated these facts to scores



Germany is tha real home of tha airship up-to-date. Allied restrictions maka it such a homa no longer. Germany is trying to do husiness in airship huilding in this country. This photograph shows the latest Zeppelin type of rigid airship now in Italy, having been confiscatad by the Allies to replace rigids dastroyed by the Germans after the end of hostilities. The Bodensee was huilt in 1919 for commercial passenger and freight traffic and she carried thousands of men, women, and children on schedule trips without mishap of any kind. *Photogroph by courtesy of Horry Vessering Americon Agent of the Zeppelin Compony.*

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of their relatives and friends. I think it is safe to assume that these 25,000 young men were real "press agents" of the flying game, that at least 25,-000,000 people of this country are today fairly conversant with its advantages. There is only one trouble with the ex-army or ex-navy flyer, as a "press agent". He was taught the art from the viewpoint of a fighting man. To him, although it might be the quintessence of sport, it nevertheless was strongly flavored with the spice of danger. And, naturally, that impression has stuck.

Therefore, I think we can safely say that the most necessary thing to be accomplished before flying becomes popular is to have fixed in the public mind the fact that it is both safe and dependable. Before flying can be made safe and dependable there are a number of things to be done, all of them surprisingly simple when the magnitude of what may develop therefrom is taken into consideration.

It was a comparatively easy thing to hew the Braddock trail and, taking into consideration the fact that it opened up a new physical continent, would seem to make the loss of life and the attendant efforts to shove through over the mountains into the fertile valleys of what is now our Middle West a comparatively trivial affair.

The first trip of Clinton's locomotive was not very difficult of accomplishment and the laying of the first rails and the grading of the first roadbeds were in themselves trivial efforts. The physical work in laying the Atlantic Cable and binding the two hemispheres by quick communication was in itself a small amount of labor when the project is considered in its largest sense. Therefore, it will be seen that it was the public *will* to do these things (in most cases guided by the minds and energies of a few farsighted people) that counted most. So when the public comes to a general realization of the real meaning of air transportation, when the average man and woman gets a great practical picture of it in mind, the things that I am about to enumerate as standing in the way of aeronautical progress will be easy of accomplishment as any of the efforts incidental to the great feats I have mentioned which meant so much for communication and transportation, two of the great needs of civilization.

Briefly stated, the principal problems now confronting aviation are:— First: The establishment of flying routes throughout the United States, equipped with, Second: Flying fields, Third: Signaling and communication systems, Fourth: Adequate meteorological service (weather forecasts), Fifth: Facilities for training flyers, Sixth: Encouragement of the design and development of new design and technique suitable for commercial purposes, Seventh: The development of a body of Federal law regulating the construction and use of aircraft. Also the establishment of an international code for the government of air flight. Eighth: Reasonable but effective standards for insurance, and the writing of aircraft insurance by all suitable insurance companies. Ninth: Encouragement of private enterprise to undertake aerial transportation.

When one takes into consideration the fact that a letter may travel even today between San Francisco and New York in 33-1/3 hours, the actual time in which a plane recently made the trip; and in 30 hours with night flying; when we realize precisely what this will mean to us when we will be able to travel the same distance in an even shorter time and in greater comfort than upon present day trains; when we realize what it will mean to the nation's defense and the nation's business when the entire country is joined together by a network of flying routes so laid out that they will serve strategic purposes in time of national emergency and commercial requirements at all times; when we realize what it will mean to world affairs when all countries will be linked together within a few hours of each other, surely the solution of problems enumerated above should not be delayed or trifled with any longer.

I mentioned as the first thing to be done the establishment of flying routes throughout the country. This work is already underway by the Army Air Service which is working on a model airway between Washington, headquarters of the Army Air Service, and Dayton, the seat of its principal experimental station. It is the purpose of the Army to establish similar model airways in every department of the Army within the limits of continental United States. The importance of this decision cannot be overestimated because these model airways will do much to prove to the public mind that aircraft are safe, dependable and very useful.

These airways will possess landing fields located at convenient distances apart and properly marked and equipped. They will be supplied with the necessary radio communication and I am told the War Department is arranging with the Weather Bureau to furnish meteorological reports covering this particular section for the daily information of those who intend to fly over it.

Even without these added and necessary adjuncts of proper flight, a total of 122,163 passengers flew 3,-136,550 miles in commercial airplanes in the last twelve months without loss of life, according to figures compiled by the Aeronautical Chamber of Commerce. These figures are based on the known performance of 245 planes and it is believed that the number of passengers and mileage would be doubled if figures on the 1000 commercial planes now operating in this country were obtainable.

On practically all inter-city flights baggage and freight were carried, the quantity limited only by the capacity of the craft. None were killed in connection with this air transportation feat. However, I must say that these flights were made where there were elements of risk which should not exist and will not exist when there

Dr. James W. Inches, Police Commissioner of Detroit and other prominent Detroiters ready to leave Miami, Fla. on an Aerial Yachting cruise to Nassau via Aeromarine 11-passenger enclosed flying boat "Columbus".

© U. S. Army Air Service

Aerial view of the State House and Common, Boston, Mass. This city is now building an airport for airplanes and seaplanes, a progressive step which all cities and towns of this country should take in order that they may be linked up in the network of airlines soon to be an established fact in the country.

are landing fields at proper distances apart, properly marked and equipped and supplied with radio communication systems and meteorological service.

Thus it will be seen that the Washington-Dayton Model Air Way, and the others which will follow it, will be a long step toward showing the public that problems One, Two, Three and Four can be solved.

The model airways will also be used as the beginning of a solution of problem Six, namely, that of training, for all the reserve officers in the Army Air Service will receive their training in actual flights over these airways.

The remaining problems are very largely dependent for solution upon the manner in which the public is impressed with the results obtained in the attempted solution of the first five. What I mean to say is this; that the vast majority of accidents to aircraft are caused by a lack of landing facilities and an improper knowledge of weather conditions. In other words, when there is an engine failure or something else goes wrong, if the pilot has within reach a fairly good sized place to land the matter is of no more moment or importance than when one's automobile breaks down. If he can be informed that he is running into a storm by means of radio, or if he runs into a fog, if he can steer by means of radio direction finder, if the fields are properly marked for day travel, and properly lighted at night, then flying will become safe and dependable.

Business men of the country should watch these model airways with the greatest personal concern because those of us in the aeronautical industry are firm in the belief that if they are managed properly they can do a great deal toward giving the American public *the will* to solve the problems of jurisprudence and therefore of liability and insurance.

However, the question of jurisprudence is a vital one as far as the inauguration and operation of aeronautical transportation companies are concerned. Those who expect to put capital into air lines must know exactly where they stand in regard to personal and property liability and opportunities for insurance before they will venture their money. Just as soon as the passage of adequate laws by the Congress takes effect, capital will be ready for investment in an enterprise that we believe will revolutionize the long-distance express and passenger transportation business.

There is a great deal more to the question of the jurisprudence of the air than one might suppose on first thought. As the matter now stands, not even the fundamental principles have actually been determined upon. There is even a question as to whether the laws of air flight should be based upon the principles of English common law, or of admiralty law. That is, whether individuals holding title to the land have title to or jurisprudence over the air above the land, particularly at such a height as in no way to interfere with their possession on the surface of the earth.

As soon as properly equipped flying fields are provided and the jurisprudence of air flight becomes established, commercial lines will be financed and started as I have said before. But these concerns in the beginning must be properly encouraged. This encouragement might well be in the form of payment for the carrying of mail and expressage and of guarantees as to the volume of such business. Compensation might be

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paid to such enterprises for keeping their facilities available for use in time of war. Guarantees of this kind, coupled with the opportunity to insure against loss by accident will undoubtedly go far toward making such privately operated transportation lines paying investments.

I do not mean to say that in the near future airplanes will not be owned to some extent by private concerns and by individuals for pleasure and sporting purposes. Already cattle men are using planes to locate straying herds and oil men are flying between distant wells. In the West air patrols are used for the detection of forest fires, and here, there, and everywhere, planes are used for stunts and advertising purposes, but what I have meant to convey here is that the real commercial development that is almost at hand will be undertaken and carried on by transportation companies organized to handle such business in a relatively large way.

I am told that railroads cost today approximately $125,000 a mile, including terminals and trackage, while the cost of an air route, based upon the experiment of the London to Paris and Paris to Brussels Routes, and those conducted in this country by the United States Post Office Department, does not exceed $5,000 a mile, including terminals and equipment. The obvious question here is what is the relative carrying capacity, as well as the relative speed of transport, safety, and comfort.

Figures compiled by the United States Interstate Commerce Commission show that of the total revenue of a railroad, 4 per cent comes from the express carried, and about 15 per cent from the passengers carried, or approximately 20 per cent of the total revenue of a railroad is from these two sources. Within the relatively near future, there is no reason why commercial aircraft lines cannot operate effectively on a comparative basis with this 20 per cent of the railroad business; and, taking into consideration the relative speed of transportation, there is no fundamental reason why such aircraft transportation cannot be provided at a cost that will be attractive for long-distance transportation.

It is trite to say that speed of installation and speed of operation are in favor of the airplane, and for the quick transportation of passengers and express where the factor of speed is taken into consideration, the airplane has advantages over all other forms of transportation.

To revert to my friend, I sketched the situation to him very much in the way I have given it here. He admitted that it was perhaps one of the most interesting problems in existence today. "But", he said, "What can I do about it?"

I knew that he was a member of one of the leading business organizations in this country, and my answer to him was that he could think and talk aeronautics in his organization and at a propitious time, he could father an aeronautical committee, the purpose of which would be to study aeronautics and to furnish a guide for his particular organization when the time came for it to lend its weight to aeronautical development. At first he was inclined to believe that such a committee would not be active and I pointed out to him that in the membership of his organization were no less than one hundred former officers of the Army and Navy Air Services. "You won't have to force these men to take an interest in this matter," I told him.

I think any organization of business men can with profit to itself organize such a committee. Former Air Service Officers are usually available and willing to engage in this work—the work of boosting the air as a medium for carrying on trade. Already a large number of commercial and civic organizations have aeronautical committees and they are functioning satisfactorily not only in talking aeronautics but in working out more practical problems.

The next step, I told my friend, would be for him, along with his house committee and his employees to take out membership in the National Aeronautic Association of U. S. A., organized to foster and encourage the nation-wide use of air navigation, and then assist in forming a local bureau of the Association, thus assuring co-operation with members and bureaus all over the country.

Many persons now living, can recall those times of fifty or more years ago when torch light processions were held, followed by mass meetings, for the purpose of urging some railroad to include that particular town upon its route. Nearly all of us have seen what happened to the town that didn't get on the railroad. It would certainly seem the part of wisdom for any city in this country today to have a local bureau of the National Aeronautic Association even if it performed no greater function than that of keeping its ear to the ground (perhaps I am mixing my metaphor in speaking of flying, so I will say, keep its ear to the wind).

So in the case of an individual who wants to know what he can do to aid in aeronautics, tell him the most practical procedure he can take is to join the National Aeronautical Association of U. S. A., and if a local Bureau of the Association does not exist in his town, to do all he can to organize one.

It would be very difficult to list all the ways in which a people gets what it wants when it wants it. It is impossible to prophesy all of the various ways in which public opinion will force the solution of the various problems which I have mentioned. but one of the ways in which all great accomplishments are carried through, whether by an individual, a corporation, or a people, is by organized effort. Once let us have public opinion crystallized on the desirability and need for commercial flying; once let us get this opinion organized, and when you want to leave New York for Chicago, you won't start your journey from a railroad station.

The Next Phase of Automotive Engineering

By Henry Ford

[The following article by the noted automobile builder appeared in the National Aeronautic Association Number of the U. S. Air Serivce Magazine.]

THE real champions of the people-at-large are our engineers and inventors. The inventor stands with the greatest benefactors of humanity. His work is permanent and the benefits thereof accrue till the end of time.

Centuries hence, the times in which we live will be remembered as the period when automobiles began to contribute their economic service to mankind, and when men first began to fly.

Today the motor car is the greatest example of how an industry can influence the everyday life of millions. Automotive development has brought to a stage of reliability and economic performance the automobile, the motor-boat, and is now being used in the large ocean-going steamer.

In view, however, of the constant search for a means of annihilating time and space, the most serious attention and consideration are being given to aviation. Here is something new. We are standing on the threshold of a new phase of transportation. There is no doubt of the continued development in the navigation of the "air ocean," and such development will far surpass in rapid service any other means of transportation on land or water.

Aviation does not compete with surface methods of transportation. It is a supplementary agency. It is the conquest of the last element in the chain of man's control of natural forces. Henceforth, time, not distance, is the unit of commercial life.

The new art of flying brings new problems to automotive engineers and inventors. When airplanes reached the speed of approximately four miles a minute at Detroit recently, the layman could be excused for thinking that the ultimate had been reached, but there is still much room for improvement. About all that we have learned so far, is that we can fly; the rest is yet to be learned.

The inventor and engineer have the

(Concluded on page 75)

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A Twentieth Century Cabin Boy

By W. Wallace Kellett

WHAT would an ocean voyage be without the irrepressible cabin boy? Ever since ships have sailed the seas these young adventurers—mere children and often little more than infants—have been just as necessary a part of the equipment of every vessel as the rudder or the Captain himself.

The heroic deeds of which these boys have been the heroes, the lives they have saved, their coolness and bravery in time of distress have so featured the stories and history of the sea, that the cahin hoy of today occupies a proud position on his ship. He has a reputation to sustain and he knows it and futhermore, he has a manner and bearing all his own through which he imparts to his passengers (for he considers them his just as much as the Captain's) a certain confidence and sympathy which no other member of the crew can give.

The little cabin boy, regarding you as you recline in your steamer chair in some carefully chosen corner of the deck where you imagine the rolling and pitching of the ship, is not quite so bad as your last resting place, is the first to perceive that you are not feeling exactly as you were when the ship sailed. Shyly approaching, he will deftly engage you in conversation and from that moment, occupied with your new and interesting friend, this little man of the sea, you are likely to entirely forget that indescribably unpleasant feeling of sea-sickness.

It is the cabin boy who carries all the news of the boat. He knows your fellow-passengers—who they are, what they do, and where they are going. He will tell you the history of the hoat, when she will make port, tomorrow's weather, the Captain's latest story. He can readily answer your every question. He seems to have an unlimited store of invaluable information.

The cabin boy is just as important to the crew as to the passengers. They wouldn't put to sea without him. He knows more of the hidden secrets, the inner feelings beneath the brawny breasts of these rough seamen than anyone in the world. He loves to be the butt of their pranks of the sea, he loves to have them tenderly curse him, order him, cajole him for he cannot help hut know in his own heart that he is loved by every sailor on the ship.

So you will find on every hoat there is one popular favorite of all on board—the cabin boy. And he really rules his small world like a king, but unspoiled, unassuming, unaware. If you ask him his title he will promptly say "Only the cabin boy, sir."

W. Wallace Kellett

His duties? They are easily defined. He does everything he is told to do by the Captain, the ship's officers, the memhers of the crew and the passengers, and does it cheerfully. Then his fertile brain suggests a thousand things which will bring pleasure or happiness or relief to someone on his ship and he does those things of his own free will.

If the ship goes down at sea he takes his place beside his Captain on the bridge and calmly waits the end. That is the cabin boy.

And so we come to Albert—the hero of this story. Albert is a cabin boy. Although he does not travel on an ocean liner and in fact has probably never even been to sea, his voyages are as wide in range and his experiences as thrilling as those of any of his predecessors who ever sailed the briny deep. For Albert is the proud cabin boy on one of the finest and fastest English Airliners flying from the great airport of London to the great airports of the Capitols of Continental Europe. He may be in London today, Paris, Brussels or Copenhagen tomorrow.

When I "snapped" Albert last June, he was in the course of conducting his passengers from his fast British Airliner to the Customs Bureau at LeBourget, the Paris Airport, after a pleasant two-hour voyage from London. His brisk walk, his business-like air and his natty uniform immediately convince one that this young chap needs no one to tell him the responsibilities of his job or how to fill it. Standing to the right with derby hat is one of his passengers. Directly back of him, his hair blowing in the propeller breeze, comes the pilot, charts and clearance paper under his arm.

Albert is one of the pioneer cabin boys of the air. He made his first flight on an airliner early last Spring when one of the leading English Airlines (thinking of the boys on every ocean liner) decided to try the innovation of the air-express cabin boy. Albert and his comrades who fly daily on these liners have quickly become just as indispensahle in the nav-

ALBERT, the first twentieth century cabin boy

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igation of the air as his co-workers in the navigation and life of the sea.

His duties? Much the same as those of the cabin boy from time immemorial. He obeys the Pilot—whom he worships like a God and as you may know by looking at Albert, his Pilot would rather lose his life than have any injury come to this diminutive boy. He obeys the mechanic, he keeps his passengers well-informed and assured at all times.

Albert knows every river, road, lake and town over which his ship flys. Whether over England or France, Belgium or Holland, he can look down from his cabin and tell you immediately just what is below at the moment. He can predict the weather and knows what the condition of the air for flying should be—if your trip is to be smooth or rough. He can tell the instant the motor misses a beat. He knows wireless, how to receive and send and what the signals mean, as well as the other members of the crew. If you are worried, Albert will assure you, if you are bored, he will amuse you and speed up the passing of long hours in the air. If you are ill, he knows just how to make you comfortable.

The little Albert I saw last June, and he is only typical of his comrades who travel on each of these British Air-expresses, seemed to me to have absorbed all the tradition, the atmosphere and hearing of those thousands of cabin-boys who have in the years gone by, developed an "esprit de corps" and a characteristic type found in few other professions. But he seemed also to be adding almost unconsciously an intangible something to all the romance and adventure of those young boys who have gone out to sea before him with the daring and love of conquest of his race.

I have never seen a keener enthusiast for flying and travel by air than Albert. He is doubtless in the air today, returning to, or outward-bound from London, his home port. By this time he has flown thousands of miles and spent hundreds of hours in the air. He has fought his way through storms and fogs, through high winds and air churned with invisible waves as ferocious as those of the most tempestuous waves of the ocean.

I sometimes wonder what Albert thinks as he wings his way at one hundred miles per hour or more, high above the clouds and earth, all attention to his Captain, the Pilot, and always keeping a careful watch over his passengers. I wonder if he has dreams of the future—of what he will become, where he will go and what he will do, when he is a grown up man, some twenty years from now? Yes, like every boy I am sure he has, and who would dare to tell him that his dreams will not come true—every one of them?

I did not ask Albert about all this, but I hope to meet this cocky little fellow again some day.

Aeronautical Fuel, Lubricating, and Cooling Systems

By John F. Hardecker, Aeronautical Engineer, Naval Aircraft Factory

AERONAUTICAL fuel, lubricating, and cooling systems, or, as they are perhaps better known, gas, oil, and water systems, present a very fruitful field for a study of the various materials used, the practical range of sizes of these materials, methods of construction, and the action of service conditions upon these materials. It is proposed to take up each of these systems, consider the various alternative materials, study the construction in detail, and then arrive at the best practice to be recommended for standard use. By giving the advantages and disadvantages of alternative materials in detail it is planned to afford the designer and manufacturer the opportunity to deviate from the recommended practice when he has some special requirement to meet for which he is willing to sacrifice certain other advantages, since, naturally, no material is "best" under every consideration and condition.

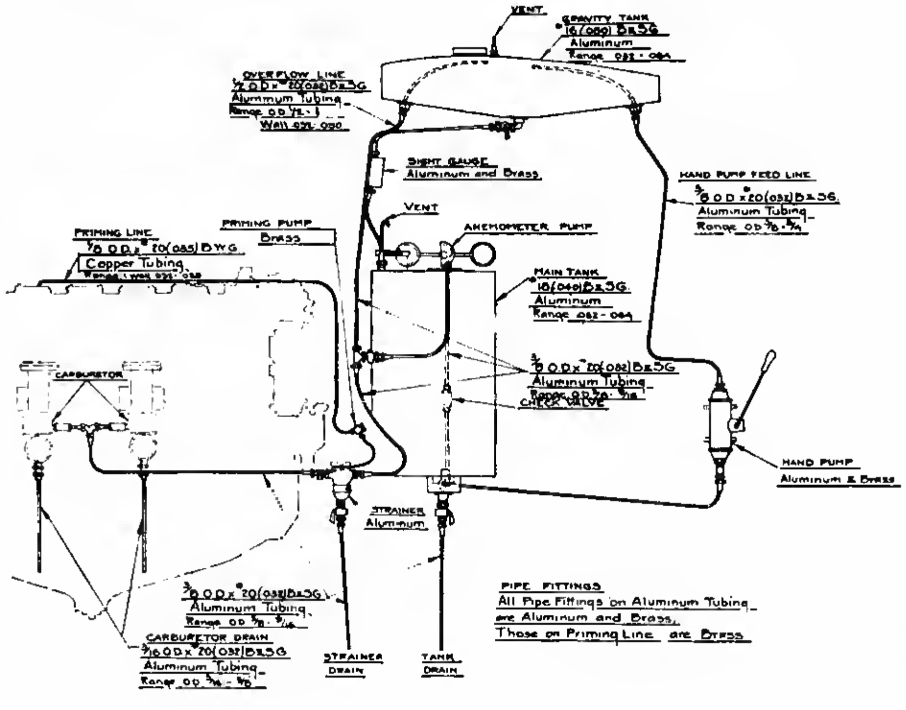

Figure 1

Fuel System

Piping material. The first material that naturally comes to our attention when considering fuel lines is copper. Copper tubing has had the most extensive use for fuel piping in the past. It has the advantages of being easy to work for the mechanic, non-corrosive, and is cheaper in cost than other materials. It has, however, two great disadvantages; namely, its excessive weight compared to aluminum, and the fact that it will corrode internally under the action of gasoline altho it is practically non-corrosive under the action of the atmosphere.

Due to the great weight of copper tubing the next material that suggests itself is aluminum. Aluminum has the advantage of being lighter than any other material suitable for this purpose, and in addition it does not corrode under the action of gasoline. Aluminum has the disadvantages of being somewhat harder to work than copper, and it must also be protected from corrosion in the atmosphere, particularly in salt air.

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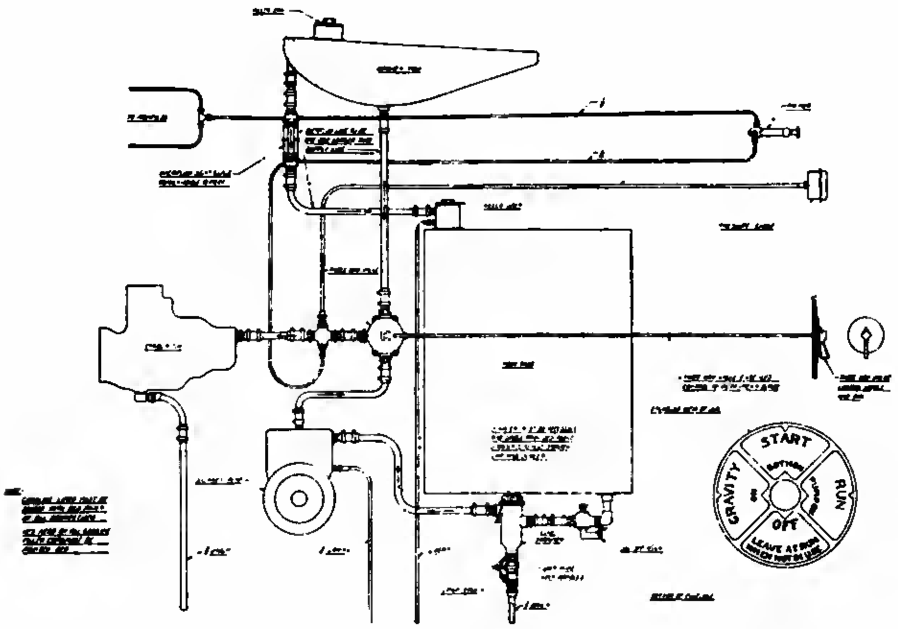

Figure 2

It can be readily protected, however, by coating with spar varnish under ordinary conditions of installation. Aluminum deteriorates slightly more under vibration than do other materials.

Duralumin tubing appears to have the advantages of both copper and aluminum, but it has had no test under service conditions nor is it easily procurable at the present time. In addition, it must be annealed before working and heat treated afterward, or, if heat treated only, the working must be confined to a short period of time after the heat treatment.

Tite flex tubing, which has only recently been developed to the point where it is gasoline tight, is extremely heavy, and its only advantage appears to be flexibility. It may find a special use in those portions of the line which are subject to excessive vibration, such as the connection from a fixed position on the structure to the carburetor on the engine. Generally speaking, this condition can be taken care of by using easy bends and loops in lines of other materials, which will readily permit of expansion and contraction.

Weighing the advantages and disadvantages of the various materials as developed in current practice, the use of aluminum tubing is recommended for standard practice in fuel lines. Its resistance to chemical action from the gasoline is regarded as very important, and the principal objection (its greater deterioration under vibration), may be overcome by using easy bends in the piping which will allow expansion and contraction. Since the primary lines are smaller in diameter than it is practical to obtain in aluminum it is recommended that copper tubing be used for these lines.

Piping sizes. In the main gasoline lines where the flow is less than 30 gallons per hour tubing should be 3/8" O. D.; between 30 and 60 gallons per hour 1/2" O. D.; between 60 and 100 gallons per hour 5/8" O. D; and between 100 and 150 gallons per hour 3/4" O. D. The wall thickness for all aluminum tubing shall be #20 (.032) B&SG. Carburetor and strainer drain lines will vary from 3/16" O. D. to 3/8" O. D. The main tank drain will vary from 3/8" to 9/16" O. D. depending upon the capacity of the tank. The overflow line from a gravity tank should be one size larger O. D. than the supply or main line, and generally range in size from 1/2" to 1" O. D. The priming line should be 1/8" O. D. #20 (.035) BWG copper tubing.

Valves and Fittings. Brass fittings of the soldered union or ring and tail type have been extensively used in the past with copper tubing. Briefly speaking, brass fittings have the same advantages and disadvantages as copper tubing with the added disadvantage that when commercial brass fittings are used, as has been the custom, the excess weight is multiplied since these fittings were originally designed to withstand much higher pressures than any found in aeronautical fuel lines.

Aluminum fittings must of necessity be of the flared union type (SAE standard) since it is not practical to depend upon the soldering of aluminum. They have the same advantages and disadvantages as the aluminum tubing with the additional disadvantage that aluminum to aluminum contact between valve and valve seat and for screw threads is unsatisfactory on account of "freezing."

Aluminum alloy fittings are in general very similar to aluminum. Lynite on Lynite shows up best when tested to determine the effect of gasoline on its bearing properties. Duralumin on duralumin results in the threads freezing under certain conditions. The possibilities of an aluminum alloy being developed that will not involve these difficulties are very good, but for the present none of those developed have really withstood the test of service conditions.

Fibre and bakelite fittings are unsatisfactory for valve and valve seat contact. Where strength is not essential this material can be threaded and may be successfully used for filler caps on tanks and for similar parts.

Rubber hose connections have the advantage of being flexible, easy to

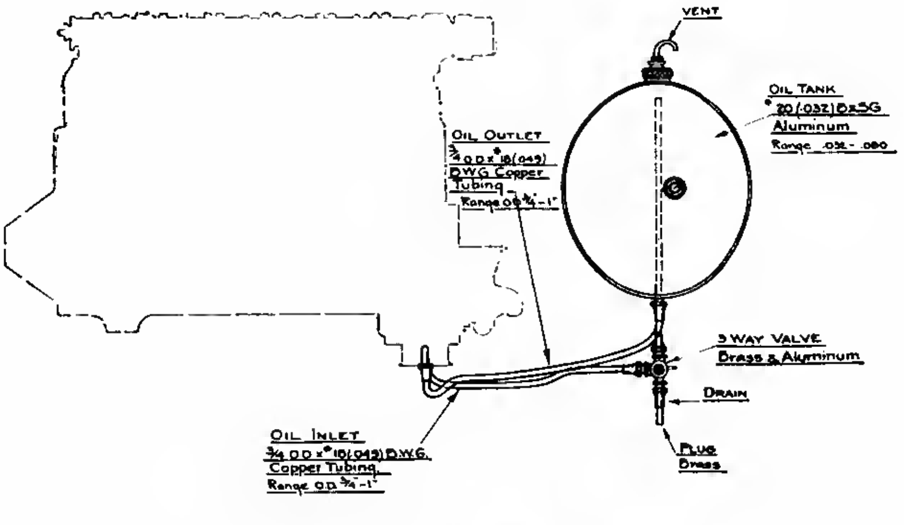

Figure 3

make, and inexpensive. Their great disadvantage is the effect caused by gasoline flow thru them. Not only does the rubber hose partly dissolve in the gasoline and thus leave a gummy mass, particles of which are carried away by the gasoline, causing a clogging of strainers and a consequent stoppage of the fuel supply line, but, in addition, the rubber yields sulphur to the gasoline increasing the corrosive effect of the fuel. Aside from the action of gasoline on rubber hose, it deteriorates rapidly.

The Dohner Compression Coupling is a new type of solderless union which has stood up well in laboratory tests. However, it is a combination of brass and steel designed for other than aircraft use and has the objection of weight. It has not yet been subjected to service tests in aircraft.

Until such time as a satisfactory aluminum alloy, which will stand up under service conditions in every respect, is evolved, it is recommended that a combination of aluminum and brass for valves and fittings be regarded as the best practice, using the SAE "flared union" type. The superiority of aluminum may thus be taken advantage of without suffering the freezing of contacting surfaces. By judiciously combining the aluminum and brass parts the amount of brass may be kept low, and its weight and corrosion disadvantages minimized. For priming lines where the fittings are extremely small, commercial brass fittings are recommended. Fibre or bakelite may be used for filler caps, plugs, etc., as previously recommended.

Tanks. Aluminum as a tank material has the advantages of not corroding under the action of gasoline, and of being light in weight. It must be protected against corrosion by the atmosphere especially in salt air. It is easier to damage tanks of aluminum than tanks of other materials in handling. It was formerly very expensive to construct aluminum tanks, but by standardization and simplification of construction the tanks made of aluminum are comparable in cost with those of other materials.

Copper has the advantage of noncorrosion by the atmosphere but the disadvantage of being corroded by gasoline. It is also extremely heavy.

Terne plate, tho relatively low in cost and easy to work, corrodes very readily inside and out. It is also quite heavy.

Duralumin has been used experimentally for tanks but has as yet not been tested under service conditions. It is very hard to work and must be heated after the tank is completed. In thin sheets it tends to distort readily, and the welding and heat treating combine to modify the shape of the tank.

Sheet aluminum ranging in thickness for No. 20 (.032) B&SG to No. 16 (.051) B&SG is recommended for standard use. Enamel baked on to tanks of aluminum furnishes adequate protection from weather conditions, and their natural location in an airplane is generally such as to protect them from possible damage.

A typical gasoline system with an anemometer and hand pump is shown in Fig. 1. The conclusions reached in the discussion of the fuel system are summarized directly on Fig. 1, which not only gives the size of tubing for the particular installation but also the range of sizes (outside diameter and wall thickness) encountered in actual installations. Fig. 2 shows another typical fuel system using a siphon pump.

Lubricating System

Piping. For the oil lines aluminum has only the advantage of low weight while under the same disadvantage discussed under fuel lines. Copper enjoys the same advantages as it does in fuel lines with its disadvantage reduced to the single one of excess weight. Duralumin and Tite flex may be regarded in the same manner as they were in the discussion under fuel systems.

The use of standard copper tubing for oil lines is the recommended practice. The only advantage of aluminum, its lightness, is greatly reduced by the small amount of piping required in an oil system. The outside diameter of the copper tubing is dependent on the size of the oil connections on the engine, while its wall thickness should be #20 (.035) BWG.

Valves and Fittings. The same considerations that led to the recommendation of a combination of aluminum and brass "SAE flared union" type valves and fittings for fuel systems apply to oil systems. Their use is therefore recommended. On experimental work it may be more expedient to use brass valves and fittings which may be purchased commercially.

Tanks. Oil tanks should preferably be made of aluminum. While the superiority of the material is not so great as in the case of fuel tanks still the saving in weight is sufficiently large to recommend its use. The tank capacity should be equal to about 1/10 that of the fuel tanks. All tanks should be provided with a vent tube.

A typical oil system installation is shown in Figure 3.

Cooling System

Piping. Aluminum piping has the advantage of being light, and it is also easier to work than either brass

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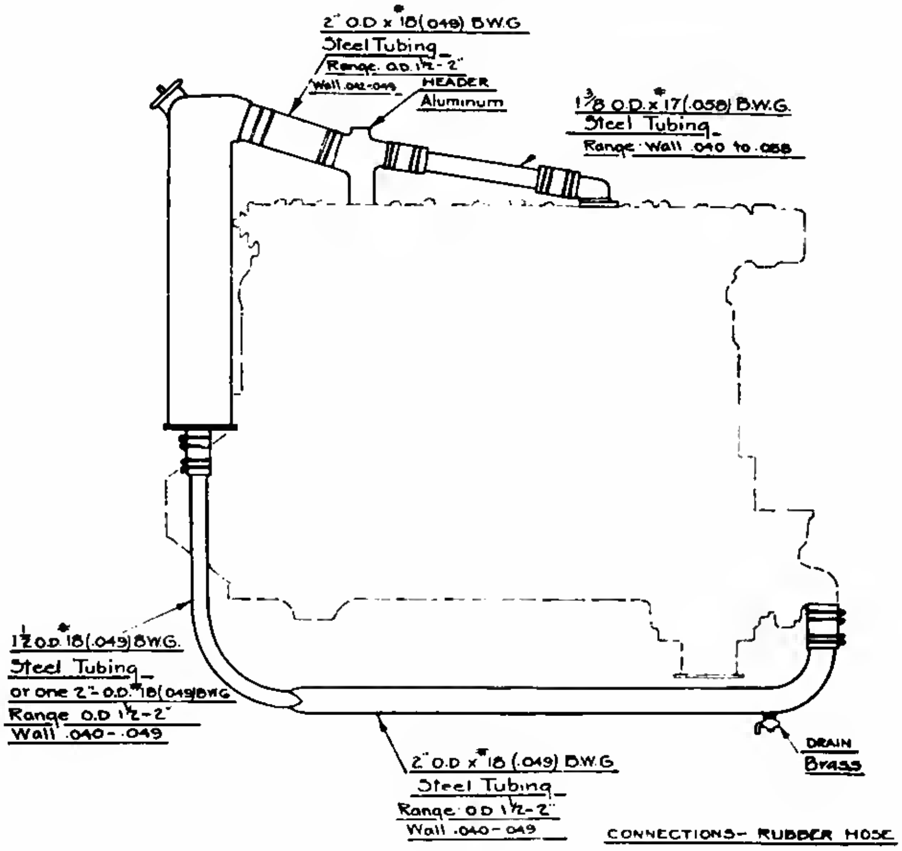

Figure 4

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The Rolls-Royce Eagle IX Aero Engine

AFTER a considerable amount of practical experience in the air, followed by much experimenting and testing, a new and greatly improved Rolls-Royce "Eagle" engine has been developed and put into production.

Owing to the many improvements which are incorporated in the design of this latest model it entirely eclipses the "Eagle" VIII which was designed primarily for fighting purposes.

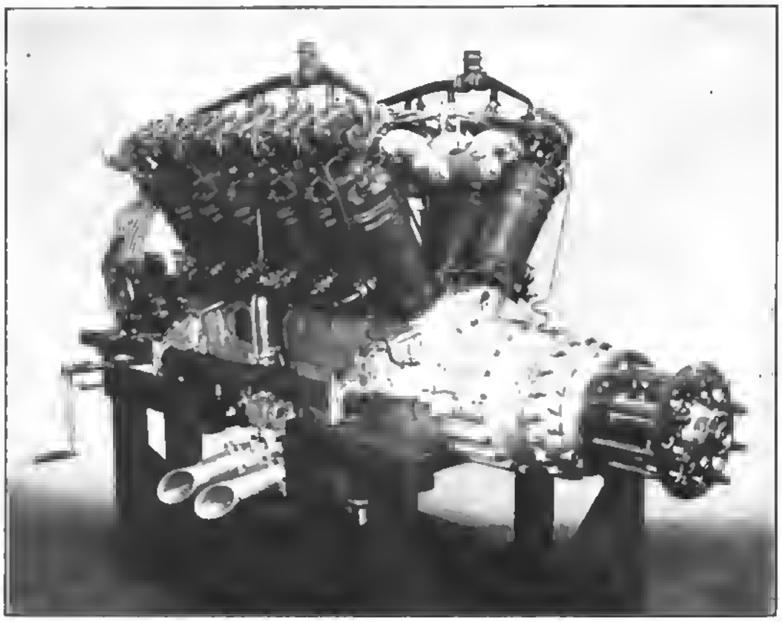
The new model, known as the "Eagle" IX, has been designed to be equally suitable for both peace and war, and amongst others has the following advantages over the out-of-date "Eagle" VIII:—

1. In order to obtain simplicity and other advantages, two carburetters are fitted (in place of four). These carburetters are low down on the centre line of the crankcase. The substitution of two carburetters in place of four considerably facilitates engine tuning and is an improvement, combined with the new induction system, for the mixture to the various cylinders.

2. In order to permit gravity feed to be used in as many cases as possible, the float feeds have been redesigned, and the engine will now function satisfactorily with a head of petrol only 8-inches above the centre line of the crankshaft, which is a great advantage in the design of the complete aeroplane.

3. The danger of fire has been considerably reduced by certain alterations in the design of the carburetters.

4. Other alterations in design have resulted in particularly smooth running of the engine without rough spots, and it is easy to maintain the running of the engine in this condition.

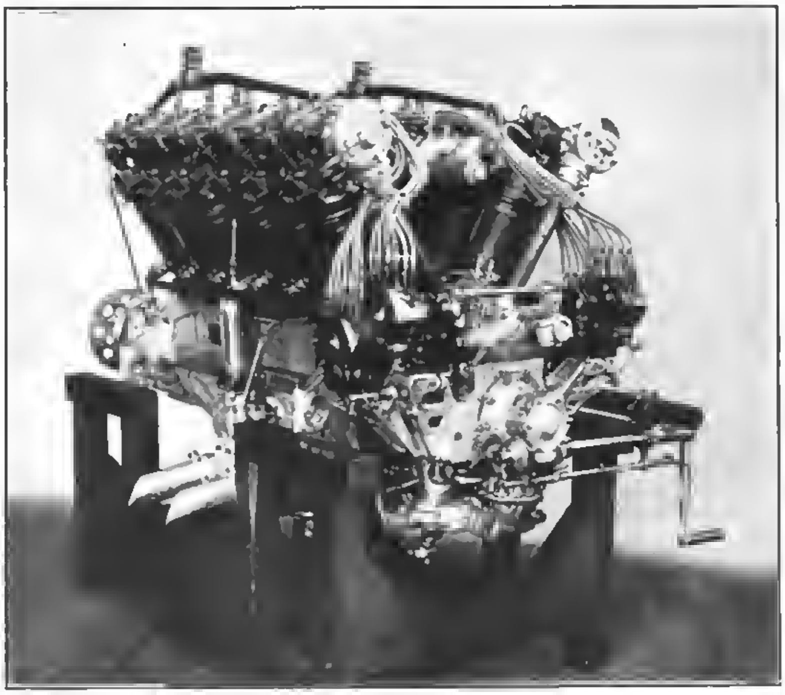


Rolls-Royce Eagle IX

5. The design has been modified in details, in order to provide increased strength or wearing qualities wherever experience has shown that the improvements could be effected.

The photographs forwarded herewith show the completeness of the new engine, and that every detailed requirement for installation has received attention in the design.

In the rear view can be seen the lay shaft, to which all the controls are led, thus making the installation and changing of engines a simple matter.



Rolls-Royce Eagle IX

The hand turning gear can also be seen. The handle is easily changed over to whichever side of the engine is most accessible, and if desired chain wheels may be used to bring the handle shaft down to any position required.

In the photographs the ignition is shown with the magnetos completely screened, and with metallic armoured ignition wires, as supplied when it is desired to use the engine in a machine fitted with wireless gear.

The rubber connections in the petrol feed have been entirely done away with, and the amount of piping reduced to a minimum.

A number of redundant Eagle VIII engines were in the possession of the British Government at the end of the war, and it is believed that these have now nearly all been disposed of, directly or indirectly, to foreign nations, etc. It is expected, therefore, that there will be in future a large demand for the new Eagle IX engines by those who are building new aircraft and require the most efficient and up-to-date engines available.

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The International Aeronautical Foundation, (I. A. F.)

By William Knight, M. E.

THE outstanding feature of the great war was undoubtedly the development of the flying machine which made its appearance, at that time, as a new and powerful weapon capable of bringing death and misery into thousands of homes far behind the fighting lines.

Since the end of the war we have further developed the rather crude and primitive instrument of destruction from the air that we had known during the war and we have made of it a deciding factor in both military and naval tactics, an almost perfect instrument possessing all the requirements for destroying in an hour a stupendous amount of lives and property. Furthermore we have transformed the war time flying machine into the peace time commercial aircraft which is probably the only blessing that the war has brought upon mankind.

As the situation stands now, we have a variety of types of military aircraft and each one of them is an almost perfect type of war engine well adapted to the service required of it in time of war. We have also a variety of types of commercial aircraft all representing more or less of a compromise between military and commercial requirements. . . . .with the results that everybody knows.

What Did We Learn from the Last War?

The great war, apparently, has not taught us any lasting moral lesson. We are now as much at the eve of a new conflagration as we were on the fateful days of 1914. Governments of all nations, not excluding our own, are just as blind to the impending signs of the storm which is coming, and shall be just as powerless to avoid its destructive effects as it was the case of a few years ago. Militarism which was blamed for bringing about the war scourge of 1914 is a good deal more powerful to-day in every country than it was ever in the past. What did we fight the last war for? What have we accomplished? What shall we accomplish in the next war? How long will it be before the people of all nations shall refuse to kill each other?

These perplexing questions have been asked by all of us time and again during the last three years and we have reached the point when we have given up the attempt to answer them and we are more or less unresistingly drifting along in the eternal stream of the history of mankind.

I think however that if we are inclined to shrink from answering general questions dealing with somewhat untangible elements, we cannot avoid answering pertinent questions dealing with realities and cold facts.

Next War Shall Be Decided in the Air

A most important reality born out of the war is the airplane. A cold fact, and not a very encouraging one by any means, is that the next war shall be decided in the air, in a very short time, and with such appalling losses which are without precedent in the history of the world, by aircraft dropping bombs, liquid fire and poisonous gases on defenseless cities far behind the battlefields. These are not dreams, these are facts which would become dreadful realities to-day if a new war should suddenly start once more, and we might as well face them.

On the other hand we have the unlimited commercial possibilities offered by the flying machines as a new means of transportation. I think it is safe to predict that the effects of aerial navigation upon the international commerce of the world shall be so far reaching that the flying machine shall become another turning point in the evolution of mankind unequalled by any other previous invention, not even by the invention of the steam engine.

In the meantime, however, commercial aviation is yet at the experimental stage and it will take years and hard work before it will become a profitable business proposition, while instead military and naval aeronautics are to-day the most practical means of offense and defense which have been devised so far.

Commercial Aviation as a Business Proposition

We all know what is going on in civil aviation in the world and, most naturally we measure its success, or its lack of success, in terms of dollars and cents, which is the proper thing to do. The present success or lack of success of civil aviation is contingent on a number of factors: mostly technical, economical and legislative. Commercial aviation needs commercial airplanes, money, laws and regulations. Before, however, money is invested to any large extent in commercial aviation developments, the matter of fair returns for the capital invested receives first consideration. On the other hand, the matter of financial returns from aeronautical investments cannot be separated from the political and legislative aspect of aeronautics (both national and international) and must be considered in its proper order of relation with other existing means of transportation. Commercial aviation cannot be created over night, the same as we created a military aeronautic organization during the war. The problems involved are entirely different and no amount of skillful propaganda boosting aeronautics will succeed in coaxing hard headed business men into aeronautical investments, unless the necessary conditions are first created whereby aerial navigation can become within reasonable limits of time a good field of investment of capital, although aeronautical propaganda is very effective in creating a good deal of public interest in aeronautical activities, and this is very important indeed. If you tell the people that aerial navigation has opened up new fields of peaceful activities whereby happiness and civilization shall be enhanced in this world they will be mildly interested and the public press will be willing to exert enough pressure upon the government to bring about the enactment of proper laws and regulations making it possible to give a start to commercial aeronautical activities. Before, however, we, as individuals give a dollar for aviation, before we entrust our lives and property to aerial transports we want to be shown that it is safe and that it pays dividends. It is quite natural that it should be so, and it is not surprising at all to see that commercial aviation is progressing slowly. Commercial aviation is advancing in a most logical way and, in spite of the fact that it is losing money to-day, there are no limits to its financial possibilties in a few years from now. In the meantime, however, the task of putting it over is left to a limited number of pioneers and far-seeing business men who are willing to discount their losses of to-day because they have faith in to-morrow. It is the same old story of the steam engine and the automobile industry which repeats itself. It is the same old reproof of the fact that, after all, the foundations of any business enterprise are: *ideals* and *faith*.

Aeronautical Preparations for Next War

While this is true of commercial aeronautics, almost the contrary is true of military and naval aeronautics. Aeronautical propaganda which cannot succeed in squeezing a dollar out of the pocket of the public, before it has been fairly conclusively demonstrated that, sooner or later, commercial aviation will pay adequate dividends, when it comes to the point of obtaining money for military or naval aeronautics, we usually start by systematically opposing all requests for increased expenditures in the costly and unproductive business of preparing for future wars.

As individuals, we are more or less mildly interested in this war business (although it is very much our own business to pay taxes for military armaments and to fight when it comes to the point where we have to fight). As a rule, we all are peaceful and we all hate wars, unless we have some old score to settle with neighboring nations. We all hate to pay taxes for military and naval armaments but, if it is proved that we have to do it (and it is always proved sooner or later), if it is proved that we are dropping behind other nations in properly providing for the national defense, why, of course we are willing to give what is needed, because we want to be protected, and as long as there is no

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other way out, we have to prepare for war the same as the other nations in the world are doing.

This is what has happened in Aeronautics. We have spent during the war and since the war hundreds of millions of dollars for developing aircraft for military uses and we have now some of the best aerial types of fighting machines. The government has not spent a cent for developing commercial aircraft and whatever we have to-day in commercial aviation is due to the initiative of a few individuals.

Scrapping Battleships and Submarines and Building Aircraft

As a matter of fact, when we review what has been accomplished in aviation in this country by individual initiative, with very little money, without government subsidies and, without aeronautical laws, we cannot help comparing the results of individual business initiative with what has been accomplished by military and naval aeronautics, figure out how much we have paid for the latter, and wistfully wonder how much it would have meant to this nation and to the world if we had spent that much money in developing a new means of transportation instead of perfecting a new powerful means of destruction.

A few years ago (or was it centuries ago?) an American had the courage of opposing a set of moral principles (we call them to-day "the fourteen points") to a world in arms. He dreamed of the establishment of a moral super-government which we remember now as a so-called League of Nations and which was supposed to make the world safe for democracy.

A few months ago the American Government startled the world with a bold program of drastic reductions of naval armaments (battleships by the way, have been subsequently proved to be practically obsolete since the development of the aircraft). The submarine was tabooed (which is almost harmless in the presence of an adequate aerial defense) but aircraft, aerial bombs and poisonous gases were left to the various democracies of the world as a means of either enforcing or defending their right of self-determination, or whatever this means.

This Nation Must Be Prepared for Another War

As I said before, we cannot deal with untangible elements such as *right* or *wrong* in any discussion involving the many complicated problems issuing from the war, and hope to solve them with the enunciation of principles. This was tried once by Woodrow Wilson, the most respected man in the world, a few years ago, and, to-day, the most respectable and the most abused man in the world who is blamed for almost anything.

We must have ideals. We must have faith in the inherent goodness of any human heing. We must try to develop the spirit of brotherhood in the community in which we live and between all nations and all races of the world. In the meantime, however, we must be practical, we cannot help having nationalistic interests to defend and to fight for. We cannot rely on the moral strength of a League of Nations or on gentlemanly agreements between governments, to protect our shores, our land and our lives. We must prepare for war, and therefore we must have aircraft, aerial bombs, liquid fires and poisonous gases, same as any other nation, until such a time when the human relationship existing between nations shall have the same meaning as that which prevails among the people of any one nation.

Until such time comes we must take the world as it is and the only way we can develop a better sense of international responsibility between governments is by taking our own share of responsibility in the work involved. So far we have been primarily concerned with national policies, and our interest in international political events has been generally limited to that extent to which our own nationalistic interests were concerned. The matter of peace and war, and the conditions which are fatally bound to bring about either peace or war, are always brought about by a few. If errors are made by the representatives of the people in domestic politics we can always correct them. If errors are made in foreign politics, we cannot always correct them and if that means war, all we can do is to fight.

Next War Shall Be Fought Against Women and Children

There seems to be something fundamentally wrong in such a state of affairs which, however, we cannot change over night—changes will take place in time through a slow but steady progress of evolution of government functions which shall, however, always be induced by the evolution of our own individual sense of obligation to our own people and to the people of other nations.

In the meantime, considering the fact that, judging from all indications, the great European War is not going to be, by any means, the last war in the history of mankind, we must prepare ourselves to see another war which, however, will be the most barbarous war ever fought and the most shameful prostitution of American genius which gave the flying machine to the world.

The next war will be fought and decided in the air, and the trend of evolution of present day military aircraft points out the undeniable fact that long distance bombing machines intended to operate at hundreds of miles behind the fighting lines against thickly populated cities, will enforce peace among the men at the front by killing the women and the children of the cities in the rear.

The war game, helas, has lost the charm and the poetry of the days when knighthood was in flower. In this highly developed industrial civilization of ours, war involves the use of powerful engines for the destruction on a large scale of human lives and property

At the beginning of the last war, the airplane almost revived the gallant individual fights of mediæval knights. The aviators of those days were the heroes of the blue sky who fought homeric single handed combats in crudely made flying machines and died like men under the sun and over the battlefield before the eyes of two opposite armies. During the war, however, the use of the airplane changed. No more blue sky and face to face combats for the heroes of the air, but the cover of darkness and the raids over Paris, London, and over dozens of cities in France, England, Belgium and Germany wrote with bombs the first pages of the history of the engineering and military developments of the aircraft.

Since that time other pages have been written and the aircraft of to-day, as I said before, is an almost perfect war engine and we must pray God that we may never fully know how efficient it is.

Should We Disarm in the Air?—No—

Should we take upon ourselves in this country the task of condemning the airplane same as we did condemn the submarine? Should we deny to our Army and Navy the appropriations that they need in order to build and to maintain our air forces up to the strength which is consistent with the safety of the nation under any conceivable emergency which may arise in the future? Should we rely on future agreements between nations, regulating the use of aircraft during the war?

To any and all of the above questions I answer most emphatically: *NO.* We cannot wipe out of our civilization the most efficient means of transportation which has been first created by American intellects and which represents the only objective lesson in internationalism which has been taught to the world by the war, when the commercial aircraft was born. We cannot, without being traitors to our country, refuse millions or even billions of dollars needed for the national defense when other nations between the prospect of bankruptcy and armaments are choosing bankruptcy. Finally we cannot rely on international treaties regulating the use of aircraft in time of war and on gentlemanly agreements between nations to be respected by all nations in time of war. We have seen in the last war how international treaties became scraps of paper, and humanitarian sentiments have no meaning at all in a twentieth century war which is fought with aerial bombs, poisonous gases and deadly bacterias.

Will the citizens of this country and the citizens of the world view with indifference the raising or rather the lowering of the

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aircraft, from the ranks of a most wonderful potential carrier of the commerce of the world, into the ranks of the most powerful destructive machine far exceeding the power of guns, battleships and submarines? I hope not.

How Can We Protect Ourselves Against Military Aircraft?

What can we do? What force can we oppose to the destructive force of the aircraft in time of war? How can we kill the military aircraft without at the same time killing the commercial aircraft?

There is a force in the world which is stronger than any other force in nature and this force is the spark of the divine within ourselves which manifests itself through any human intellect each time that we perceive the divine relationship existing between all creatures of God. Unfortunately, however, the human race has not progressed yet far enough along the path of spiritual development and we are unable to perceive at all times and in all cases such a relationship.

Human nature, however, is fundamentally good at any time and in any circumstance and is wonderfully responsive to any appeal which is made to this sense of humanity when such an appeal is not motivated by a selfish purpose. The fact that after two thousand years the teachings of Christ are yet the foundation of our present day civilization is a proof of such a contention. The fact that the fourteen points enunciated by Wilson during the war were accepted by the people of all nations is another illustration of this fundamental truth.

Men, however, who in their individual relations with other men are regulated by their own finer nature (more or less modified by education and by the surroundings in which they live), in their collective relations with other groups of men are influenced by the mentality of the particular group to which they belong and which is to a great extent directed by a limited number of men possessing the power for good or for evil to shape public opinion and to create public sentiment—I think that the presidential campaign in this country in 1916, the election of Woodrow Wilson on a platform of "We are too proud to fight" and the subsequent change of a few months later shows the power of leadership over the moulding of public opinion and public sentiment.

The International Aeronautical Foundation (I. A. F.)

Why not make use of these two tremendous forces in order to curb the evil power of military aeronautics: *The inherent goodness of human nature in the individual and the organized power of mass psychology artificially created for an unselfish motive?* It is with this view in mind that the idea of the International Aeronautical Foundation was born.

What is the International Aeronautical Foundation? It is an idea to-day, which shall become a powerful force to-morrow under the able leadership of a small group of women and men animated by the unselfish desire to serve the cause of their country and of humanity. It is the beginning of a movement which carries within itself enough force to stop war forever. It is the blossom of a seed sown by the first citizen of the Confederation of Nations: Woodrow Wilson, the greatest veteran of the late war and the leader of a movement who can be judged only by history.

I shall try to outline briefly the proposed object of the International Aeronautical Foundation (I. A. F.)—The purpose of this projected organization is to enlist in its membership individuals and organizations of all countries in the world who are prepared to endorse the first fundamental principle of the I. A. F.—*FIRST: TO RESPECT, TO UPHOLD AND TO HELP TO ENFORCE ANY INTERNATIONAL LAWS AND REGULATIONS AGREED UPON BY CIVILIZED NATIONS REGARDING THE USE OF AIRCRAFT IN TIME OF WAR, AND IN NO CASE TO USE OR TO CONCUR IN ANY WAY IN THE USE OF AIRCRAFT IN TIME OF WAR FOR THE PURPOSE OF DESTROYING HUMAN LIVES AND PROPERTY BEHIND THE ONE OF OPERATION OF THE ARMIES.*

Any individual and any organization of any country in the world who can take the pledge to live up to the first fundamental principle advocated by the I. A. F. can become a member of the Foundation.

The Second fundamental principle of the foundation, the acceptance of which is optional, is as follows: *Second:—To help furthering the advance of aeronautics and to encourage the use of Commercial aircraft along both national and international lines.*

The Purpose of the I. A. F.

This organization should be non-political, non-sectarian and truly international in spirit and in actions. Its main purposes being:—

1) To create in this country, a popular educational movement leading to the condemnation of the barbarous warfare tactics, inaugurated in the late war, when, through the use of aircraft and poisonous gases, the military operations at the front were extended behind the zone of the armies against civilian populations.

2) To concur to the establishment of local groups in foreign countries for the extension of the work of the I. A. F. in every civilized nation, such as to create an international movement sufficiently strong to force the adoption of international laws and regulations and to bring about in all countries appropriate reduction of aerial armaments which shall sufficiently guarantee that, as long as wars shall have to be fought between civilized countries, time honored respect for the rights of noncombatants and for the sacredness of international treaties shall not be trampled upon again.

3) To create in this country and to concur to the creation in other countries of a sense of international responsibility between scientists and technical men engaged in advancing the progress of aeronautics and sciences thereto allied, in the final use of their inventions. To offset any unfair use of such inventions and to help to disseminate knowledge in aeronautics, in the interest of the commerce of the world, a cordial exchange of information and technical data between scientists and technical men in the world should be established through the I. A. F. and the knowledge thereby acquired should be disseminated among the members of the federation through publications edited by the foundation.

4) To encourage scientific research work in aeronautics and to promote the study of international problems involved in the political and the business aspect of international aerial navigation.

5) To promote a spirit of international co-operation and a sense of class responsibility among members of aeronautical clubs and associations of all countries in the world which are in any way concerned with aeronautical activities.

These are briefly the main objects of the I. A. F.

I have been informed by a number of perfectly honest and well meaning people possessing the gift of a critical mind that my project is not practical because it is very much in advance of our times, but is otherwise a very beautiful and realistic dream which everybody should be glad to see become a reality.

I consider such a comment as a great compliment and I see once more in this comment a proof of the eternal struggle between the spirit and the critical mind, between the natural creature of God and the artificial product of education and surroundings and I bless the Lord for preserving my power to dream, without impairing my facility to deal with realities (which has been my lot during twenty-two years of successful work as an engineer and as a business executive).

A Dream and a Practical Reality

I shall try now to outline briefly how, in my estimation, the beautiful dream could become a practical reality.

Let us assume that an organization committee is formed, composed of a dozen or so of representative men possessing the gift of leadership and who have been fortunate enough to go through life, fighting all its hard battles, without losing confidence in the goodness of human nature (and there are thousands of such men in this country and in every other country in the world).

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Let us also assume that enough money is collected among people who are fortunate enough to be able to give, and that a well organized educational and membership campaign is started in this country.

The first move in this campaign, in my estimation, should be to interest the women of this country, through their many organizations and I think that the American Gold Star Mothers organization should have the privilege of being the first member association of the I. A. F.—Women, unlike men, have been endowed by nature with a keen sense of justice which is not obscured by their highly developed mental powers, and is never submerged in the mass psychology which dominates men. Women were intended by nature to bear children who are the nearest to God that we can conceive of, and it was for the grace of the Lord that they received a higher soul than man. Women in this country are one of the most powerful social factors and with their support and their active collaboration, the I. A. F. can and must be organized.

The second move should be to enlist in the membership of the I. A. F. educational institutions. Let all the children, young girls and young men in the country know that their school has endorsed the first fundamental principle of the I. A. F.

After this is done go after the American Legion, the Association of War Veterans, the Red Cross, the Y. M. C. A., the Y. W. C. A., the Churches of all denominations, the Labor Unions, go after every Association, Club, or congregation of men and women in this country which is willing to pledge its allegiance to the first fundamental principle of the I. A. F.

When this is done, start an individual membership campaign and start it from the top—enroll the President of the United States and the members of the Cabinet. Enroll every member of Congress and every member of the Air Service of the Army and Navy.

By the time that this is done in this country a similar movement will be well under way in all other countries in the world and it will only be a matter of skillful organization to create a single powerful international non-political and non-sectarian organization with far reaching possibilities for the future and possessing the two irresistible forces which I have mentioned before:—*THE APPEAL TO THE INHERENT GOODNESS OF HUMAN NATURE AND THE ORGANIZED POWER OF MASS PSYCHOLOGY ARTIFICIALLY CREATED FOR UNSELFISH MOTIVES BY A FEW LEADERS POSSESSING IMAGINATION AND CRITICAL POWERS.*

But let us go still further with the beautiful realistic dream:

Membership Organization of the I.A.F.

The way I consider the practical membership organization of the I. A. F. is as follows:—

Membership in the I. A. F. should be divided into three classes: Honorary members, Active members and Inactive members.

Inactive members should be requested to pledge their allegiance to the first fundamental principle of the foundation and to contribute to its financial support with voluntary donations only. This grade of membership to be open to individuals and organizations not directly engaged in aeronautical work.

Active members in the I. A. F. to be divided into five grades:

1—Fellow member
2—Senior "
3—Associate "
4—Junior "
5—Candidate "

The five grades of membership as mentioned above from number one, which is the highest, to number five, which is the lowest, to be open to individuals actively engaged in aeronautical work graded according to the importance of the work that they are performing.

Grade three, associate membership, to be open to both individuals and organizations engaged in the performance of aeronautical work. All other grades of membership to be open to individuals only.

Honorary Membership to the I. A. F. to be open to individuals and organizations:—

First—who have made exceptionally important contributions to the work of the I. A. F.

Second—who have made exceptionally important contributions to the development of aeronautics and sciences thereto allied.

Third—who have made exceptionally important contributions towards the establishment of better relations between nations and between fellow men in the interest of peace and progress.

This is, briefly, the outline of that beautiful dream which I have called the International Aeronautical Foundation and which could have almost any other title from the most conservative and dignified: "League of Humanity for the sake of Humanity" to the futuristic title: "Aeronautical League of Nations" or the revolutionary title: "International of the Air".

I have tried very hard to convince myself of the unpracticability of realizing this dream, but I must confess that I cannot see it that way.

Where are the ten or twenty leading men and women who will compose the organization committee of the I. A. F?

Where are the champions of a beautiful dream, who have the gift of being able to dream and to act?

Emergency Landings From Low Altitudes

THE large percentage of accidents in the Army Air Service in taking-off caused an investigation which discloses interesting facts and statistics of prime interest to every pilot, operating manager and insurance. An analytical report has been prepared by the Air Service under the above title and *Aerial Age* presents the outstanding features following.

It was found that these accidents were due to the efforts of pilots to turn back into the field when engines failed on the take-off, without sufficient altitude to complete the turn.

For each design of airplane there is a minimum altitude below which a complete 180 degree turn can not be made. Following is a tabulation giving these minimum altitudes. Full military load is considered in each case. If the airplane is flown without full load, the altitude lost will be proportionately less.

The altitude given for each type should be taken as an absolute minimum for a complete turn of 180 degrees, and can only be obtained by following fairly closely the air speeds and angles of bank which are recommended. Both theory and experiment point to the fact that a reasonable deviation from these conditions does not greatly increase the loss in altitude, and, with average piloting, an airplane can be turned back with

(Concluded on page 90)

Model	Total Wt. in lbs.	Minimum Altitude in Feet	Most Efficient Air speed in M. H. P.	Best Angle of Bank	Radius of Turn in Ft.
DH4	4297	340	75	45°	380
SE5	2058	270	70	45°	330
JN4H	2200	230	60	45°	240
MB3	2548	400	78	45°	400
XB1A	3679	300	73	45°	360

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Sailing the Air With Wind Power

By D. W. Starrett

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AT the present time there is a concerted effort to sail aeroplanes without power, other than that of the wind. It seems that the impetus for this movement comes from the remarkable results that have been attained by F. H. Hentzen, the young German aviator, sailing his motorless glider, *Vampyr,* over the Rhone valley in Germany, as recorded in the *Literary Digest,* of October 7th, 1922.

Some writers would like to make a mystery of this remarkable feat, as tho he had discovered a new law, and were liable to give it to the German government, which would use it against the Allies. France, especially, is wrought up over the fact that this aviator stayed in the air for three consecutive hours.

France, however, need not be nervous over the results of this flight. Should the principle which will be disclosed in this article reach the German aeroplane builders, the Allies will have cause to be excited, unless they use a little reason relative to the matter.

No doubt aeroplanes can be constructed so that without other than wind power, they will be able to carry great loads, and sail where they desire to go.

The accomplishments in motorless aeroplane flights, recorded in the *Literary Digest,* Oct. 7th 1922, of Orville Wright, in Oct., 1911, and recently those of Mr. Glen Curtis, as well as those of other German aviators beside the one mentioned, have set the flying world agog.

In 1908 the present writer copyrighted the principle about to be disclosed, and it was published in 1910, in the *Philadelphia Inquirer,* and in March, 1912, in the New York *Aircraft.*

He disclosed in those articles the mechanics of motorless aeroplane flights, which might continue as long as the wind blows. The wind blows all of the time somewhere, and it always blows along discovered tracts with as much certainty as it does over the ocean enabling sailing vessels to carry the world's freight.

There are two principles involved that will enable one to accomplish the results attained in Germany in motorless aeroplane flight, and wingless flight by many kinds of birds.

It is known that the frigate bird can stay in the air indefinitely. It steals its food from other birds on the wing, and rises to great heights and sleeps while sailing without wing movement in great circles. The great swooping crane will rise from Lake Winnipeg, and set its wings and sail straight to the Gulf of Mexico, never once during its flight flutter its wings for propulsion purposes.

Man so far has not imitated the birds in this regard.

The present scheme of sailing gliders by wind power is nothing more than taking advantage of the rising currents of air, very much as a piece of paper rises on the up-currents of air and floats for miles. But it is obvious that the use of such currents will never enable the German to do much damage anywhere with motorless machines for the purpose of dropping dynamite upon his enemies. It would have no chance whatever with a motored aeroplane manned by a skilled aviator. And as to that, no machine driven alone by wind power will ever be able to cope with war aeroplanes driven by engine power and manned with guns.

The great principle to be disclosed in this paper means that aeroplanes using it will only be able to carry articles of commerce and passengers cheaply.

In 1910 the writer constructed an apparatus that proved the principle of bird wingless flight.

Two sheets of typewriting paper were pasted together to form a wedge, with the thickness of the sheets for the thin edge of the wedge and braced apart with paper ribs five-eighths of an inch for the thick end. At each corner a fine wire ring was pasted through which wires could be passed. These wires were stretched about four feet above the ground, and the paper wedge was placed, with the wires passing through the rings, so that the thick end faced the wind squarely.

The wedge was placed upon the wires at rest, almost instantly it moved directly into the teeth of a fifteen mile gale. A test was made and it was found that starting from rest it moved against the gale thirty feet in eight minutes.

Inertia was overcome by the wind power. It is true that birds rarely start from rest, but it is because they naturally hop when making a start, for wingless flight.

Birds always face the wind when sitting in a gale, for otherwise they would be blown over, the wedging of the body and wings causing the wind pressure to balance them closely. For instance, if they light upon a flag staff they face the wind or the direction in which the steamer is sailing, depending upon which is the stronger.

From this it may be realized that a motorless aeroplane properly constructed as regards the wedging angles of wings and body, and due regard paid to a frictionless surface, such as feathers present to the wind, can carry freight and passengers in any direction, with a power equal to that of the wind. With very little momentum one could start from rest, as the model proved.

The principle used by the gliders will never be able to carry much load, because they do not utilize very much of the wind power.

The principle here disclosed is far different from that utilized in the gliders. The wind strikes the blunt end of the wedge and it is compressed against the air above and below it, which acts as a storage power, like a spring, so that as soon as it gets by the thick end of the wedge it rebounds against the angles of the wedge, and squeezes it forward. With the bird this occurs both on the wings and body.

Such a machine can even do what ships accomplish upon the ocean, tack at almost any angle from the direction of flow of the wind, up to about thirty degrees.

To sail with the wind in such a machine one will have to volplane for a certain distance, then circle into the wind to gain lost height, and then repeat the operation indefinitely. This is why birds circle when making wingless flight with the wind.

The reason why aeroplanes have not made such flights, is because the wings have not been given sufficient wedging power, and their surfaces and that of the body have not been given proper frictionless surfaces.

The Soaring Wave

By J. Ed. Sheriff

I HAVE been interested in soaring flight for some thirty years, and was delighted by your splendid report of the European success in this line.

There is a very important factor in the accomplishment of true soaring that is very generally ignored, namely, the soaring-wave.

I discovered the soaring-wave in the summer of 1913 by the use of smoke streamers placed to windward of an aerofoil.

It is in all probability the soaring-wave that makes it possible for the albatross, turkeybuzzard and hawk to soar over great plains and the sea; and to do so on cold,

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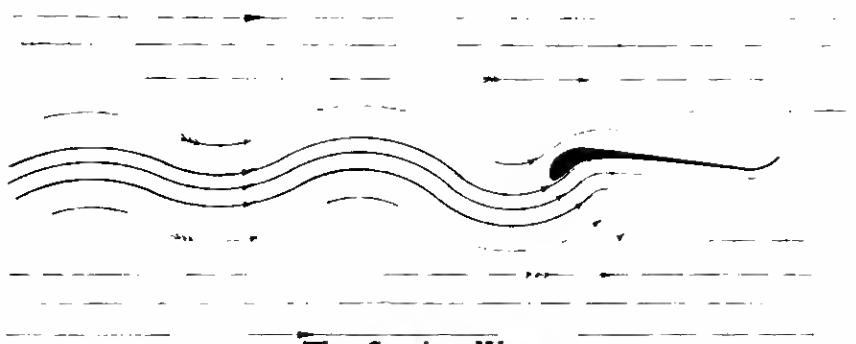

The Soaring Wave

cloudy, windy days when there is no logical excuse for even suspecting rising currents.

The soaring-wave is apparently generated on the wing and later extends to windward in gradually decreasing waves. See accompanying drawing.

When a hawk does a soaring hover he always drifts for about one-half second while the soaring-wave is extending to windward.

In a yacht race to windward, all else being equal, the boat with maximum working leach in mainsail will win; because it will generate a greater soaring-wave.

The non-technical theory of soaring flight based on the soaring-wave, and without ascending currents, is quite simple. There must be a wind. A wind is a horizontal movement of gaseous fluid mass, relative to the bird and the Earth. Gravity as an invisible kite-string connects bird and Earth. With the entering edges directed to windward the air can pass the aerofoils (wings) in the shape of a wave or sinuous current only; which, following the laws of fluids in motion, extends a considerable distance to windward. Now, as the length of the sinuous path is greater than the straight course of the wind, this sinuous stream (the soaring-wave) will be accelerated by the surrounding air in motion, i. e. it will be acted upon just as though it were a liquid wave. Thus the wind will be slowed, in giving up energy to the wave.

Due to the shape of the wing and its position relative to the wind, the wave cannot strike it on the upperside, but can strike the underside, thus thrusting forward and upward.

With a strong, steady wind or gale, blowing over a great plane on the sea, a true soaring bird can travel rapidly against it, without employing circling flight, or rising currents. Circling flight is resorted to in light breezes, as it is another means of extracting additional energy from the relatively moving air.

In the midst of a great plain, on a cold cloudy day, with the ground cold and a steady gale blowing roofs off barns; I have seen a turkeybuzzard rise vertically from a carcass and soar out of sight to windward without circling; having gained altitude of some 2000 feet.

The Fokker Amphibian

DURING the Fall of 1922, the Fokker factory at Amsterdam has produced a new type of Amphibian flying boat, which shows many interesting features and is characterized by excellent flying qualities, a characteristic for which flying boats have up to the present not been particularly noted.

Primarily designed for Naval Observation purposes, especially in the Dutch Colonies, the Fokker Amphibian is however adaptable to many commercial purposes, a number of the constructional features making especially for economical operation.

The *boat* is entirely constructed of duralumin and has proved to have very favorable lines for a quick get-away. The type of construction used is very simple and much more easily repaired than is usually the case with metal constructions. Great strength fore and aft is obtained throughout the boat by continuing the keel upwards in the form of a central girder up to the deck of the boat. There are eleven watertight compartments, which are formed partly by the central girder and partly by the bulkheads. The closed sections are accessible through manholes. The bottom of the boat has two open steps.

The *Seating Arrangements* in the Naval type are as follows: In the bow is the observer's cockpit with emergency controls. The seat and the controls can be folded away when not in use, when it is desired to use the gun ring. Through a passage on the starboard side of the boat, access is obtained to the mechanic's cockpit, which is to the right of the pilot. The pilot's complete *controls* with the seat, are mounted on a detachable frame forming one unit. The mechanic's seat can be folded up and it is then possible to pass through to the next compartment, which provides complete accessibility at all times to the *collapsible undercarriage.*

The shock absorbers and entire lowering and raising mechanism can in this way be reached even during flight and adjusted if necessary.

The *undercarriage* is very simple and consists of short axles and radius

The Fokker Amphibian on Water

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rods hinged to the boat, with compression struts which run diagonally upwards from the wheels into the boat. These latter telescope for raising and lowering the wheels. The raising crank can be actuated by the Pilot, or by the mechanic, or even by the observer in the bow. The lowering of the wheels is instantaneous and automatic, but the pilot has also a pedal with which the locking wedges can be further positively locked after the wheels have been lowered.

The *Gasoline Tanks,* which are in the next compartment aft of the landing gear, have a capacity of 120 gallons.

The Fokker Amphibian on Land

Further aft is a *second observer's cockpit,* which brings the normal number of crew up to four.

An extremely strong, steerable, combined *tail skid* and *water rudder* is attached to the rear step.

The good flying qualities of the Fokker Amphibian are particularly due to the special arrangement of the wing panels. The upper plane, built in two parts entirely from wood and veneer covered, is considerably swept back and attached to a steel tube strut pyramid on the boat. The bottom plane, which is in one piece and also constructed entirely of wood, lies in a considerably staggered position with respect to the top plane, and directly on the boat; it is not back swept but has a slight dihedral. The wing bracing is by struts only, in the form of a modified Warren girder. The wing tip pontoons are made from duralumin and suspended or shock absorbers. If for special purposes, the wings can be also constructed entirely of metal.

Power Plant Installation on the Fokker Amphibian

The *tail unit* is very simple in construction, it consists of a thick cantilever fin with rudder and a tail plane with elevator. The tail plane incidence is adjustable from the pilot's seat, the adjusting mechanism being carried inside the fin. The entire construction of the tail surfaces is in a steel tube, fabric covered.

The *engine* is mounted with the radiators and the oil tank as a unit, as in the latest Fokker Commercial planes. This unit, consisting of engine, radiators, water connections and tank, oil tank and oil connections and exhaust stacks is connected to the engine bed only by four holts and can be hoisted away from above without dismantling any parts of the plane; the engine bearers are provided with permanent feet so that the entire unit can be set on the ground without damage to the radiators, crank case, pumps, etc.

The engine fitted at present is a 450 H. P. Napier Lion, but owing to the arrangement of the wings and the engine bed it is possible to fit practically any other engine, such as the Liberty, with very little alteration and without affecting the balance.

Leading dimensions and weights:

Span upper plan	59 ft. 9"
" lower plane	34 ft. 6"
Cord upper plane	7 ft. 10"
" lower plane	5 ft. 10"
Length over all	39 ft. 5"
Height	10 ft. 9"
Weight empty	4000 lbs.
Weight loaded	5760 lbs.
Gasoline capacity	120 gallons
Speed	120 m. p.h.

Take-off, fully loaded, 20 seconds.

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The 1000 H.P. Avro-Napier Bomber

The 1,000 H. P. Avro-Napier Bomber

By Major F. A. de V. Robertson

ON Dec. 15th the first aeroplane in the world to be driven by a 1,000 h. p. engine made its trial flight at Hamble aerodrome near Southampton. This great Napier engine is known as the "Cub", being, so to speak, the offspring of the famous 450 h. p. Napier "Lion". The "Cub" is an X-shaped engine, each limb of the letter being represented by a row of four cylinders, making 16 cylinders in all. Its length from front to rear is 7 ft. 6 inches. Its weight is 2,200 lbs. without water or fuel, and as it will undoubtedly develop at least 1,100 h. p., it weighs no more than two lbs. per horse power developed. The engine is the property of the British Air Ministry, and consequently it is not permissible to give more details about it, but some idea of its efficiency may be gained by pointing out that a locomotive engine of similar power would weigh over 147,800 lbs.

The aeroplane designed for this monster engine is a product of the firm of A. V. Roe & Co. Ltd. It seemed particularly fitting that this firm should he chosen to design and build the first machine to take a 1,000 h. p. engine, for Mr. Roe was the first man to fly in Great Britain in a British-built airplane. He accomplished this feat in 1908 in a triplane of his own design and construction, in which he installed a 9 h. p. J. A. P. engine. He is thus also the only man to have flown with a 9 h. p. engine; and his career from the days of 9 h. p. to those of 1,000 h. p. is one of the romances of modern science. In 1906 he was one of the few men in Britain who believed in the first reports of the success of the Wright Brothers, and he made bold to write to them. He was very proud when he got a reply from Wilbur. He wrote on the subject of their flights to the "Times" also, and incidentally described his own experiments. The paper in publishing his letter added the comment:—"It is not to be supposed that we in any way adopt the writer's estimate of his undertaking, being of the opinion, indeed, that all attempts at artificial aviation on the basis he describes are not only dangerous to human life, but foredoomed to failure from an engineering standpoint." When the first British flying meeting was held at Blackpool in 1909, Roe took his triplane there, but the weather was too boisterous for the 9 h. p. J. A. P., and the machine would not leave the ground. Friendly press critics, some in sorrow and some in anger, advised him to copy the French designs. One wrote contemptuously in his paper of Roe's "astonishing optimism", his "inability to take a leaf out of the book of our successful neighbors across the Channel", and his "unwillingness to build on the lessons of other experiments". Fortunately for all concerned, Roe stuck to his own theories. In 1910 he visited the United States hy invitation and attended the flying meeting at Boston, where he crashed badly. He was very kindly received by President Taft. It was not his first visit to your country, for he had first gone there in 1893, and again in 1906 when he was employed as engineer and draughtsman by S. L. O. Davidson, who was trying to produce a sort of helicopter at Montclair. The first item in the press cutting book of the Avro firm is an extract from the "Denver Times" of June 12th, 1906, describing this incident in Roe's career. It is headed by a fanciful picture of a future flying machine, a monoplane with deep fuselage and high-lift wings, which looked very strange a few years ago, but now appears as a highly intelligent antic-

Bert Hinkler, Test Pilot

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ipation of events which do not seem at all improbable. The rows of windows indicate that there is more than one deck inside, and the Avro bomber which is the subject of this article has actually got two decks.

Later in 1910 Roe designed a tractor biplane which set the fashion to the world for several years and is still the most popular type of aeroplane. In 1912 he brought out the famous 504 type of Avro, still very widely used as a training machine for embryo pilots.

The latest product of the Avro works is strangely unlike the familiar 504K. For one thing, it is almost entirely built of steel. The wings are well swept back, in the fashion which one associates with the German Taubes, which used to intrigue us in the early days of the war. As the photographs show, it is a tractor biplane with monoplane tail, while the undercarriage has four wheels, a system usually only adopted in the case of twin-engined aeroplanes. The lines are beautifully clean, and even before the trial flight one felt certain that the machine would perform well.

The pilot who tested it, little Mr. Bert Hinkler, is an interesting personality, who has well deserved the distinction, which he now holds, of being the first man to fly a 1,000 h. p. engine. He is an Australian from Bundaberg in Queensland. In 1920 he bought the original Avro Baby with 35 h. p. Green engine, an engine which has been used by Roe in 1910, and in that summer made a non-stop flight from London to Turin, 600 miles in 9½ hours, on 20 gallons of petrol. Then he shipped his Baby to Australia and there made a longer and faster non-stop flight from Sydney to his native Bundaberg, just to see his home and his parents. His inches are not many, and he looks just the man to tuck himself inside

Avro-Napier 1000 H.P. Bomber

an Avro Baby. When he climbed up the ladder to the cockpit of the 1000 h. p. bomber he made the onlookers realize more fully than they had done the massive proportions of the machine and engine.

The trial flight was entirely successful. The Avro showed a good climb and gave promise of easy manœuvrability. Hinkler said afterwards that she is a very nice machine to fly and very delicate on controls. If she proves as nimble in the air as is expected, she will be able to carry out bombing raids without any escort of scouts or fighters. She will be heavily armed of course and will carry two pilots, while the petrol tanks used are self-sealing and will neither leak nor catch fire if pierced by bullets. Therefore she should be able to hold her own against a number of enemy aircraft. All will hope that she will never be used for war in our time—but if we attempt to look into the future, what terrible monsters of the air are we to include in the picture?

Resume of Progress of Aeronautical Matters in Congress

THE Aeronautical Chamber of Commerce has prepared the following bulletin covering the progress of aeronautic matters in Congress:

Dec. 4 *House.*

Helium resources of the U. S. would be conserved under a bill introduced on May 4, 1922, by the Chairman of the House Committee on Military Affairs and now pending before the Committee on Public Lands. During the week of hearing upon the bill at which tes-December 4, the committee held a timony was received from members of the scientific staff of the Bureau of Mines. Other hearings may follow during the week of December 11, at which time the committee may hear representatives of the air forces of the military and naval establishments (HR-11549) (From Chamber of Commerce of the U. S. Legislative Bulletin No. 77)

Dec. 5 *Senate.*

Annual report of the National Advisory Committee for Aeronautics transmitted by the President. S. Doc. 270.

Dec. 6 *House.*

Annual report of National Advisory Committee for Aeronautics transmitted to the House.

Dec. 7 *House.*

Mr. Hicks, a bill (HR-13238) to authorize the Secretary of the Navy to procure, purchase, manufacture or construct additional aircraft for the Naval Establishment; to the Committee on Naval Affairs.

Dec. 9 *House.*

Reports of Committees on Public Bills and Resolutions. Mr. Hicks:

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Committee on Naval Affairs (HR-13238. A bill to authorize the Secretary of the Navy to procure purchase, manufacture, or construct additional air craft for the Naval Establishment, without amendment (Rept. No. 1269). Referred to the Committee of the Whole House on the state of the Union.

Dec. 11 *House.*

Petition 6566. By Mr. Kissel: Petition of National Aeronautic Association of the U. S. of America, Washington, D. C. on a national policy for air; to the Committee on Interstate and Foreign Commerce.

Dec. 12 *House.*

Executive Communications Nos. 821, 822, and 823. Letters from the Chairman of the National Advisory Committee for Aeronautics giving items of expense of the N. A. C. A.

Dec. 14 *House.*

In discussing Naval Appropriations bill (HR-13374) Mr. Lanham asked the amount of money to be expended on helium in the Bureau of Aeronautics appropriation. $500,000 was the amount.

Dec. 16 *House.*

Mr. Campbell of Kansas submitted a privileged report House resolution 466 (Rept. No. 1280) "Resolved, That during the consideration of the bill HR-13374 making appropriations for the Navy Department and the naval service for the fiscal year 1924, it shall be in order to consider without the intervention of a point of order, provisions of the bill or amendments thereto relating to appropriations to procure, purchase, manufacture or construct additional aircraft for the Naval Establishment, including the necessary spare parts and equipment therefor, at a total cost not exceeding $5,798,950, and also that part of the appropriation bill on page 55, lines 12 to 17 inclusive."

House.

In the Naval appropriation bill (HR-13374) a total sum of $14,647,174 was allotted to the Bureau of Aeronautics.

The Army's Man-less Airplane

FOUR years since the armistice, and more, yet only now has it been possible to acquaint the American public with any details whatever of the automatic pilot-less airplane developed during the war and subsequently to a point of satistaction as far as its mechanical operation is concerned.

The Army Air Service has now completed its long series of experiments, beginning during the war, in the endeavor to produce a small airplane, of a span of 20 feet, with 60 h.p. air cooled engine, capable of carrying a useful load of 250 lbs., which would take-off, climb to any predetermined height, level out, maintain that level and lateral and longitudinal equilibrium, and steer a straight course, barring side drift, without a pilot aboard.

The automatic airplane has no need of a horizon and functions equally well in fog and in clouds as in clear weather. By comparison with human piloting the machine is observed to take a straighter and steadier course as soon as the automatic control is thrown into action.

In 1911 the Sperry Gyroscope Co. began experimenting with an automatic pilot and by 1913 had perfected an apparatus which, though delicate and complicated, functioned. In 1914 the Sperry device won a prize for the development in a series of tests in France, against a large number of competitors. The device was worked upon then as a means of safety and to relieve a pilot of fatigue on long flights. The gyroscope was the foundation of the system.

In the Army's device, two separate and distinct gyroscopic units are used in the stabilizing and the maintaining of the course. These gyroscopes are electrically driven from a generator geared to the engine and run continuously during flight. The sense of direction, whether vertical, horizontal or fore and aft, is taken from its respective unit and transmitted by means of leakage ports in the pneumatic system which in turn controls relay valves delivering a suction to the power pneumatics. These relay valves and tubes controlling this supply of power correspond to the nerves in the human body. The power pneumatics are directly connected to the control surfaces of the airplane and the supply of vacuum is maintained by a pump, gear driven from the airplane engine. The gyroscopes function as the brain, the relay valves and tubes as the nerves and the power pneumatics as the muscles.

Taking-off automatically, climbing to a predetermined height, and maintaining this altitude is accomplished by changing the relation between the vertical position of the gyroscope controlling horizontal flight and the normal horizontal position of the plane. This is done mechanically by the use of evacuated diaphragms, which by their gradual expansion upon increase in altitude, operate a relay valve. In other words, in setting up the machine for flight this mechanism is so adjusted as to give the "brains" or gyroscope controlling the horizontal flight a slightly biased view of just what is horizontal, thereby allowing the plane to climb at a slow rate. When the desired altitude is reached the diaphragms have expanded a known amount, due to the rarefied atmosphere, throwing into action the corrective mechanism, which immediately "levels off" the plane and from that time on until the termination of the flight the plane flies in a perfectly horizontal position, neither gaining nor losing altitude.

The take-off is slightly different from that of the human pilot, in that as soon as the engine is opened up, the airplane assumes its position of normal slow climb and in this position runs over the ground, gaining speed until it finally rises.

Another feature that has been developed is the distance log or gear. This is an air fan, registering distance of advance for a given number of revolutions. The desired distance of flight is scaled from an accurate map and corrected for windage. This is set on the distance gear before starting and correctly measures the desired length of voyage.

In actual work, hundreds of take-offs have been made, with automatic flights up to 90 miles in length.

This pilot may be mounted in any type airplane.

A group of any number of these, loaded with explosives, could be directed on their course by radio from a human-piloted guide plane and steered to their mark. During the war this country found it possible to guide large bombs by radio while falling, it will be recalled. One can easily imagine a machine like the Sperry messenger with an explosive load in place of the human pilot.

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The N. A. C. A. Three Component Accelerometer

THE Accelerometer is one of the new instruments designed by experts of the National Advisory Committee for Aeronautics for use in experimental research on aircraft in *free flight*. It is a device for obtaining the magnitude of the load factors in flight and for procuring information on the behavior of an airplane in various maneuvers. A series of articles on these instruments was begun in the December issue of *Aerial Age*. All these are of profound interest to students and designers, pilots and manufacturers. If instruments such as these were on the market they would be found of extreme value by every experimental plant and manufacturer in the world.

When an airplane is flying on a straight and level course a spring scale with a 1-pound weight attached to it would record 1 lb. If, however, the plane were put into a turn or a zoom, the scale would no longer record 1 lb. but may record 2 or 3 lbs.—e.g., the apparent weight of objects on the airplane has increased several times. Should the stick be suddenly shoved forward to put the machine into a dive, the spring scale may read zero—e.g., an object on the plane might have no weight. When a spring scale is used in this way the pound graduations on the scale represent accelerations in terms of the acceleration of gravity, g, which is in English units about 32 ft. per sec.

If the average loading of the wings is 10 lbs. per sq. ft. in level flight, during a maneuver in which the spring scale reads 3, the wings would then be carrying a load of 30 lbs. per sq. ft. The readings of the accelerometer, therefore, give the loads that the airplane structure must undergo during a maneuver and also the load that the pilot and passengers experience. Every pilot knows he is pushed down into his seat during a tight spiral, for instance, and it is almost impossible to stand up or lift the feet from the floor. During violent stunts a 180-lb. man may increase in weight to as much as 800 lbs.

Accelerometer Shows Ability of Pilot

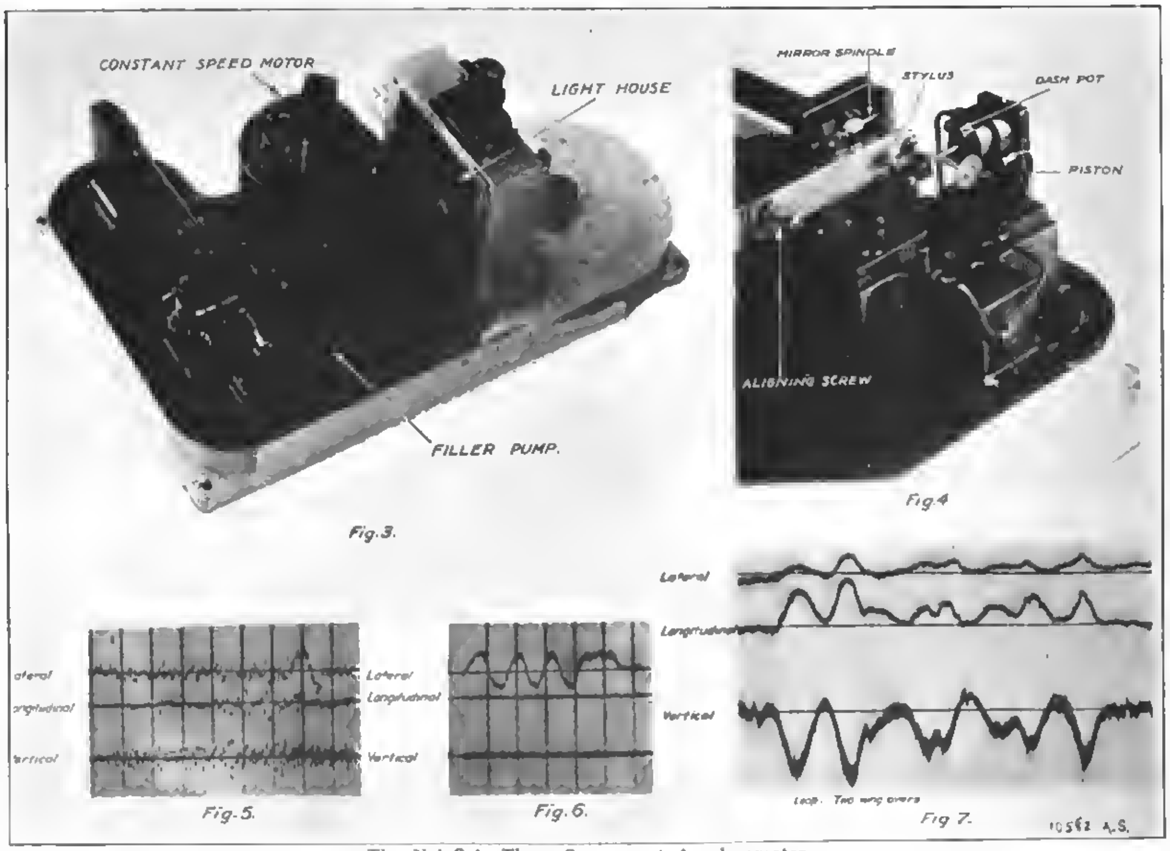
The accelerometer records are of value to the designer as they show him what stresses the airplane structure undergoes and how long these stresses last. The records also show clearly the pilot's ability, especially in stunts and landings, so that an accelerometer should be an excellent means of examining a flier, as it gives a clear and unbiased record of his handling of a machine. Here the insurance companies are interested.

Description of the Instrument

This new instrument measures and records accelerations along three mutually perpendicular axes. Previous instruments have only recorded accelerations in an airplane along a single axis. In order to measure the acceleration along the three axes of an airplane simultaneously it is necessary to have three accelerator movements, each mounted perpendicular to one of the axes. These three movements, for convenience, have been incorporated in one instrument.

Photographs and diagrams are shown in Figs. 1-4. The construction, as may be seen from Fig. 3, is similar to the other standard N. A. C. A. instruments, which make their records with a pencil of light deflected by a mirror on a film in the same manner as movie films now record speech. The new device like its companions uses an optical system, recording drum, and driving motor.

There is a light source consisting



The N.A.C.A. Three Component Accelerometer

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of a single lamp, so that the three mirrors form separate images on a single film. The three curves are distinguished from each other by means of a revolving shutter which gives a dotted and a dash record from two of the mirrors. As in the case of the other instruments there is a timing lamp to synchronize the records and to give time intervals.

The principal features are shown in Figs. 1 and 2. Fig. 1 shows the arrangement of the three springs and the corresponding axis along which each records the acceleration. The motion of the end of each spring is transmitted by the stylus—a small pointed screw—to the mirror as shown in Fig. 2. The X and Z springs register directly, but the motion of the Y spring must be transmitted through a bell crank. The moving parts are made very small and light to reduce their moment of inertia and a hair spring on each mirror spindle takes up all backlash.

To adjust the sensitivity, the spring may be moved along its own axis or the weight of the screw near the free end may he changed. This screw is also used to align the axis of the spring, that is, to make the axis parallel to one of the three mutually perpendicular faces milled on the case. By moving the screw in or out or adding a small weight to either side, the effective axis of the spring is thus shifted. The zero is adjusted by means of the stylus.

The motion of the springs is damped by a small dash pot on the end of each, as shown in the Figs. 3 and 4. Three dash pots have a very close-fitting vane and the clearance around the stem is kept small as

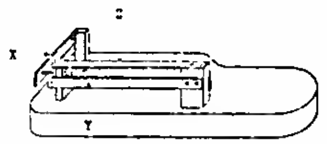

Fig. 1. Showing the arrangement of the strings and the axes of the instrument.

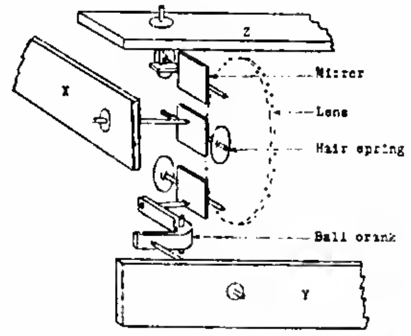

Fig. 2. Showing the means for transferring the motion of the springs to the three mirrors. The dash pots are omitted.

possible in order to prevent the leakage of oil. For convenience in filling, each of the three dash pots is connected by a small hypodermic tube to a pump which fills all simultaneously.

Precision

After manufacture, the instruments are calibrated, and the accuracy of the instrument as used in the air is determined then by the accuracy with which the records can be scaled. The records can easily be measured to 0.01 inch, which corresponds to 0.12 second of time. The acceleration normal to the wings may be measured to 0.04 g. and the lateral and the longitudinal to 0.025 g., the difference being due to sensitivity of the springs.

Records

Fig. 7 shows a record taken in the air with no timing intervals and before the damping on the Z spring was improved. The first part represents a loop and the second two wing-overs in quick succession. It will be noticed in the loop that the acceleration along the Z axis is about 3 g., the normal position of the zero line being 1 g. The acceleration at the top of the loop is less than normal, but never reaches zero, as there was no tendency to hang. The longitudinal acceleration is 0.75 g., or approximately 24 ft./sec.^{2} (deceleration). In these maneuvers there was very little lateral acceleration and it is thought that it may be necessary to change the sensitivity of the X spring. In any case, the sensitivity of the springs may be readily changed to suit the problem in hand.

Summary of Some Records

The following table gives the maximum acceleration found in various maneuver:

Maneuver.	Machine.	Maximum acceleration.
Porpoise landing	JN-4H	5.25 g.
Pancake, 4-foot drop	JN-4H	4.95 g.
Loop	JN-4H	3.68 g.
Roll	JN-4H	4.20 g.
Spin, maximum in pulling out	JN-4H	3.12 g.
Spin	DH-4B	2.78 g.
Do	Bristol	2.72 g.

From these figures it would seem that in no reasonable stunt would the air load ever exceed 4.5 g. A normal landing should not give more than 3 g., and a very rough landing will seldom exceed 5.5 g. It is quite possible that on a high-speed scout machine, higher loadings than these would be experienced in stunting, but the accelerometer records taken by the Bristol in mock fights show no loads in excess of 4.5 g.

(Concluded from page 58)

job of making the improvements which will guarantee economic performance, reliability, longevity, and safety in automotive equipment as applied to air navigation. And then the people of the country will have the job of adapting aircraft to the economic and commercial phases of our national life. Once given the safe and economical aerial vehicle, the public will find many uses for it.

Second Annual Aeromarine Report

The operation of the Aeromarine-Navy Flying Boats in the Commercial Transportation of passengers, mail and freight for the period commencing November 1st, 1921, and ending November 1st, 1922, is herewith submitted:

SOUTHERN DIVISION:

268,535 passenger miles were flown in 744 flights and 2,399 passengers carried.

The services maintained included Key West, Havana, Miami, Bimini, Nassau and Palm Beach, also special flights from New York to points in Florida and Cuba.

NEW YORK DIVISION:

57,658 passenger miles were flown in 807 flights, and 2,380 passengers were carried.

The services maintained included New York, Atlantic City, New York-New England points, and New York-Aerial Sightseeing.

GREAT LAKES DIVISION:

412,854 passenger miles were flown in 574 flights, and 4,388 passengers were carried.

The services maintained included a double daily service between Cleveland and Detroit; sightseeing flights on Lake Erie and Lake St. Clair; also special flights from New York to Cleveland and Detroit via Albany, Montreal and Buffalo.

1. Three types of flying boats were used in these operations:

11-passenger flying cruisers, F5L type

6-seat converted Navy Coast Patrol Boats, HS2L type

3-place Aeromarine flying boats;

2. Not a single passenger or employee was injured during these operations.

TOTALS:

Passengers carried	9,107
Passenger miles flown	739,047
Numher of flights made	2,125
Accidents	NONE

SUMMARY:

These figures added to those of our first year's operations show a complete total of more than 1,000,000 passenger miles flown, and more than 20,000 passengers carried without a single accident.

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The Civil Aeronautics Act

VERY definite progress has been made in furthering air legislation. The Hon. Samuel E. Winslow, chairman of the House Committee on Interstate and Foreign Commerce, introduced on January 8th the Civil Aeronautics Act of 1923. Commenting on the Bill Mr. Winslow said:

"The Civil Aeronautics Act of 1923, as introduced by me in the House today, is the mature result of months of inquiry into our need for basic legislation in this new and important field.

"The Wadsworth Bill which passed the Senate last February contained the elements of the desired legislation, but after being referred to the Committee on Interstate and Foreign Commerce of the House, I realized that the subject was so vital in its relation to the future security and prosperity of the nation, that inquiry into every angle was necessary. Thus, with the sympathetic co-operation of Secretary Hoover and Dr. Klein, Chief of the Bureau of Foreign and Domestic Commerce, I have gone thoroughly into the subject.

"It was soon apparent that it would be necessary to redraft the proposed legislation in respect of constitutional questions involved; the situation presented by the International Air Navigation Convention; certain departmental differences; the adaptation of the existing customs, immigration, public health and other regulatory legislation to air travel; some necessary administrative details, as well as certain questions in respect of torts, crimes and court jurisdiction of matters relating to air navigation, as well as questions of form, arrangement and clarity. Mr. Frederic P. Lee of the Drafting Service of the House, now Chief Draftsman of the Senate Drafting Service, was requested to make a thorough comprehensive study of the situation. The bill has been constructed under his advice.

"Representatives of the Commerce, War, Navy, Treasury, Post Office and Labor Departments, National Advisory Committee for Aeronautics and such civilian organizations as the Aeronautical Chamber of Commerce, National Aeronautic Association, Society of Automotive Engineers, National Aircraft Underwriters Association, as well as the Aviation Committee of the American Bar Association, and the Commissioners on Uniform State Laws, have participated in our conferences. The bill as introduced by me today is the result. We believe that it will meet the needs adequately and constructively.

"The Act, in brief, provides for the establishment in the Department of Commerce of a Bureau of Civil Aeronautics. The Act is divided into five parts and establishes authority for the inspection and licensing of aircraft and pilots, establishing and certifying air routes and terminals, as well as rules of the air and their administration and so co-operating with our Military, Naval, Postal and Commercial air activities that the whole can literally be co-ordinated into the Air Power of the United States. Aviation is, perhaps, the most significant mechanical development of this generation, contributing as it does to the speeding up of transportation and forming the key of our national defense on land and sea.

"In his inaugural message, President Harding urged legislation for the regulation, relief and encouragement of aviation. The establishment and development of Civil Aeronautics has the endorsement of the administration. The basis of Air Power must be a healthy, self-supporting aircraft industry. Among the needs of this industry are increased public confidence, increased capital and more favorable insurance rates. Public confidence will expand as the hazard of aviation diminishes. Capital undoubtedly will enter the field as soon as our basic law governing the operation of aircraft is established upon a sound and broad basis, and under responsible management and direction and reduced hazards, reasonable insurance rates will follow. It is confidently expected that the proposed Civil Aeronautics Act of 1923 will solve practically all of these prohlems."

Great credit is due the Aeronautical Chamber of Commerce in securing this much desired action on the part of Congress.

Our Too-Free Air

BEFORE steamboats and motor-driven craft can begin to navigate they must be inspected by government authorities to make sure that their seams won't open or their engines blow up at inopportune moments. Steamboat pilots, too, must be examined and passed by government authorities, so that boats won't be piloted by persons who may carelessly run them ashore or into other boats. The person who failed to grasp the need of such inspections and examinations would be almost universally regarded as somewhat weak in the head.

All over the United States today, however, there are civilian aviators whose knowledge of flying is imperfect. These aviators are not under government control. They can fly when they like and where they like. The machines in which they fly are not inspected by the Government. Consequently they can take up any machine that can be coaxed to leave the ground. As a result many of them fly in machines that should he strictly confined to the junk heap. In these machines civilian aviators fly blithely over large cities, swoop gayly over masses of people that congregate at fairs and football games, and take up passengers to whom all airplanes look alike. Only a few states and cities have passed regulations forbidding planes to be flown over crowds at low altitudes, though army regulations strictly forbid military aviators to do it.

If the boilers of a steamship explode, or if she is run on the rocks by an unskilled pilot, there is an excellent chance that the passengers will escape unscathed. If an airplane breaks in midair, or an unskilled aviator loses control of his plane, there is scarcely a chance of escape; nor are the city and the people beneath in a particularly enviable position. The need for a law putting the control of civilian airplanes and aviators into the hands of the Federal Government is imperative. *Editorial in the Saturday Evening Post*

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Howard E. Coffin, Pres. B.H. Mulvihill, V. Pres. **Official Bulletin of** B.F. Castle, Treas. John B. Coleman, Rec. Sec.

National Aeronautic Association of U.S.A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D.C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

BY COURTESY of *Aerial Age* the National Aeronautic Association of U. S. A. is permitted to present to its members and to the public-at-large, the roster of the Officers, Governors, and Committee Members of the National Headquarters and the nine Districts throughout the country.

The President of the Association is Howard E. Coffin of Detroit, Vice President of the Hudson Motor Car Company, formerly a member of the Naval Consulting Board, Council for the National Defense, Aircraft Production Board, and the American Aviation Mission. Mr. Coffin's business address is—Hudson Motor Car Company, Detroit, Mich.

The Resident Vice President is Bernard H. Mulvihill of Pittsburgh, President of the Natural Gas Conservation Company. He was an Officer of the 107th Field Artillery and the U. S. Air Service. His business address is B. F. Jones Building, Pittsburgh, Pa.

The Treasurer of the Association is Colonel Benjamin F. Castle, an Officer of the Irving National Bank, New York, a graduate of U. S. Military Academy at West Point, and was Lieut. Colonel in the Army Air Service, and Aviation Attache to the U. S. Embassy at Paris. His business address is: Irving National Bank, New York, N. Y.

John B. Coleman, Recording Secretary of the Association, is a broker and manager of the John B. Coleman Company of Sioux City, Iowa. He was a Second Lieutenant and Observer in the Army Air Service during the war. His business address is 305 Metropolitan Building, Sioux City, Iowa.

FIRST DISTRICT

The First District of the National Aeronautic Association comprises the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. Porter Adams, the Vice President and Governor is an Engineer and President of the A. I. D. Inc., Developing Engineers. He is a graduate of the University of Redlands, California and of the Massachusetts Institute of Technology. He was an officer in the Naval Aviation force during the war. His business address is—1352 Beacon Street, Boston, Mass.

Godfrey L. Cabot, Second Governor of the First District is one of the oldest Pilots in the country, is a manufacturer and, during the war was an officer in the Naval aviation forces, and Commanding Officer at the Marblehead Aviation Camp. Mr. Cabot has been identified with aeronautical activities in this country for many years. His business address is 940 Old South Building, Boston, Mass.

SECOND DISTRICT

The Second District of the Association comprises New Jersey, New York, Delaware and Porto Rico. John D. Larkin, Jr., of Buffalo, N. Y. is the Vice President & Governor of this District. Mr. Larkin is a manufacturer, and is President of the Larkin Company of Buffalo. During the war Mr. Larkin was active in war work having turned over his entire industry to the work.

His business address is—Care of the Larkin Company, Buffalo.

THIRD DISTRICT

The Third District of the Association comprises Maryland, Pennsylvania, Virginia, and District of Columbia. The Vice President and Governor of this District is Mr. L. F. Sevier of Pittsburgh who is a well-known automobile man. His business address is Forbes & Craig Sts., Pittsburgh, Pa.

Mr. R. J. Walters, the Second Governor of this District is President of the Tire Corporation, and a Director of the National Tire Dealers Association. Mr. Walters was a Captain in the Army Signal Corps during the war. He is the owner of a seaplane transportation company operating from Baltimore. His business address is 500 Pennsylvania Avenue, Baltimore, Md.

FOURTH DISTRICT

The Fourth District of the Association comprises Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee. The Vice President and Governor of this District is Mr. L. Sevier, who is President of the Alabama Manufacturers Association and who has been connected for many years with the railroads and the steel manufacturing business in the South. His business address is care of the Alabama Manufacturers Association, Birmingham, Ala.

Van Hampton Burgin is Second Governor of this District and is a member of the firm of Burgin & Moore, Insurance. During the war Mr. Burgin was in the Army Air Service, 13th Aerial Squadron, 2nd Pursuit Group; fought on the Toul Sector and St. Mihiel drive. His business address is 217 Healy Bldg., Atlanta, Ga.

FIFTH DISTRICT

The Fifth District of the Association comprises Indiana, Kentucky, Ohio and West Virginia. The Vice President and Governor of this District is Glenn L. Martin, an airplane manufacturer of Cleveland, Ohio. Mr. Martin began building airplanes in 1907 and has been a flyer since 1908. He won a medal for an over-ocean flight from Newport to Catalina, California in 1912. His business address is 16800 St. Clair Ave., Cleveland, Ohio.

Mr. Dudley M. Outcalt, Second Governor of the Fifth District is a lawyer and was an officer in the Air Service, serving with 90th, 141st, 95th and 94th Air Squadrons, and later, with the Army of Occupation in Germany. His business address is Traction Building, Cleveland, Ohio.

SIXTH DISTRICT

The Sixth District of the Association comprises the states of Illinois, Michigan and Wisconsin. The Vice President and Governor of this District is Mr. Charles S. Rieman, the President of the Elgin Motor Car Corporation, and the President of the Chicago Aeronautical Bureau. His address is 22 West Monroe Street, Chicago, Illinois.

The Second Governor of the District, Sidney D. Waldon, President is of the Detroit Aviation Country Club and Vice President of the Detroit Motor Bus Company. During the war he was one of the group who produced the Liberty Motor. He was a member of the Aircraft Production Board and Assistant Chief of the Equipment Division Signal Corps, and served with the Army Air Service as Colonel in France. His address is 4612 Woodward Avenue, Detroit, Mich.

SEVENTH DISTRICT

The Seventh District of the Association comprises the states of Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota. Ralph W. Cram, the Vice President and Governor of this District is the Editor of the Davenport, Iowa, Democrat and Leader. Mr. Cram has been identified with Aviation activities for many years and has written much on the subject of aeronautics. He is a leader of aviation activities in the middle west. His business address is Davenport, Iowa.

Mr. Howard F. Wehrle, Second Governor of the Seventh District, is District Manager for the Kincar Manufacturing Company, and also President of the Flying Club of Kansas City. He served in the Army Air Service during the war in this country and over seas in the rank of Major. His business address is 503 Railway Exchange Building, Kansas City, Mo.

EIGHTH DISTRICT

The Eighth District of the Association comprises the states of Arizona, Colorado, New Mexico, Oklahoma and Texas. The Vice President and Governor, Edgar C. Tobin of San Antonio, Texas, is engaged in the automobile business in that city, as sales manager for the Hudson & Essex Distributor Company. During the war, Mr. Tobin was first with the Lafayette Escadrille, and then in the Army Air Service. He is an Ace and is credited with the destruction of six enemy planes. He has been decorated with the Croix de Guerre, and the D. S. C. by the United States. His address is Roman & Oakland Streets, San Antonio, Texas.

The Second Governor of this District is Wm. Long who was a flyer in the Army Air Service, and who travels extensively by airplane. Mr. Long flew last fall to the Detroit Aviation Meet from San Antonio, Texas.

NINTH DISTRICT

The Ninth District of the Association comprises the states of California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Utah, and also Alaska. The Vice President and Governor of this District is P. G. Johnson, who is connected with the Boehing Aircraft Corporation. His business address is 2432 North Broadway, Seattle, Washington.

Mr. C. H. Messer, the Second Governor of this District is an electrical engineer, and is the President of the U. S. Aircraft Corporation, conducting a commercial aviation business in the northwest. He was a pilot and instructor in the Army Air Service during the war. His business address is 1302 West Second Avenue, Spokane, Washington.

GOVERNORS-AT-LARGE

The Association, in accordance with its

(*Concluded on page* 89)

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THE NEWS of THE MONTH

Federal Aeronautic Control

Colonel W. Jefferson Davis, California Lawyer, who represented the War Department, as special counsel, at the Congress on International Aviation Legislation at Prague, is in Washington co-operating with Congressional Committees on the proposed Federal bill governing Aeronautics.

While in Europe, Colonel Davis was attached to the American Embassy at Berlin, as legal advisor to the Military Attache, and after the conclusion of his detail for the War Department, made an extensive study for the American Bar Association of Civil Aviation in Great Britain, France and Italy.

Colonel Davis is counsel for the newly formed National Aeronautic Association, and a member of the Aviation Committee of the American Bar Association.

For several years he has endeavored to bring about Federal legislation for the Air Service. The proposed Federal bill will create a Bureau of Civil Aeronautics in the Department of Commerce.

Colonel Davis states that, "Congress is faced with the immediate necessity of enacting Federal legislation providing for uniform air laws. The only surprising thing is that this country, a pioneer in flying, should be so long without vision in solving fundamental questions of jurisprudence for the control and regulation of flying. Such a Federal bill, if passed, will become the charter for civil aviation, and will be a basis for the control and sovereignty which the Federal Government can, and should, properly exert over the air.

"In 1917 the nervous energy of the American people expressed itself in preparing its young manhood for service at the front. In the immediate future, this same energy and activity should be expressed in training the youth and talent of the country for efficient service in the air, not only for national defense, but for commercial enterprise.

"The airplane will be a most important link in future national defense. Commercial projects, with airships and airplanes plying between the larger cities of the country will spring into being, as soon as Federal legislation is secured. Commercial aviation has long since passed the experimental stage, and there is immediate necessity for well defined laws governing aeronautics. Early action by Congress will have a marked effect in the development of a new transportation industry."

Sesqui-Centennial Exhibition

The Sesqui-Centennial Exhibition to be held in Philadelphia in 1926 will include a great airplane building with an aerodrome for exhibition purposes, demonstrating world achievement in the navigation of the air.

St. Louis Wants 1923 Air Races

Major Howard F. Wehrle, Vice-President of the Air Terminal Association of Kansas City, Mo., and a Governor of the National Aeronautic Association, was a guest at a dinner tendered two weeks ago by the St. Louis committee seeking to obtain the 1923 National Air Races. At the meeting of the N. A. A. governors in New York Jan. 15th, Major Wehrle will make a report on facilities and preparations for the proposed meet at St. Louis.

Lieut. Tinker with N.A.A.

Clifford B. Tinker, director of publicity for the National Aeronautic Association, (headquarters at 26 Jackson Place, Washington, D. C.) has an interesting article in the December number of "Our World" Magazine. Mr. Tinker was formerly aide to the Chief of Naval Aviation.

American Legion for Commercial Aviation

At its national convention in New Orleans, October 16th-20th, 1922, the American Legion adopted a resolution providing for an American Legion Committee of Aeronautics, "whose functions it shall be to so co-operate with the U. S. Army Air Service and other nationally recognized institutions and organizations devoted to the interests of Aeronautics, and through the medium of our local posts, country and state organizations and national organization, to arouse the interest of the people in the developments of commercial aviation, at such times and places as conditions and circumstances may warrant." The resolution further provided that the committee consist of five members, appointed annually by the National Commander, and serving without pay. Major Reed G. Landis, of Chicago, son of Judge K. M. Landis, has been appointed Chairman of the committee. On Major Landis' invitation, the Aeronautical Chamber of Commerce is co-operating with the Committee and is supplying it with data and reports from time to time.

Philadelphia as an Airport

At a joint meeting last night of the Engineers' Club and the Aero Club of Pennsylvania, at Philadelphia, a movement was launched to make Philadelphia one of the greatest airports in the United States and the world. The subjects under discussion at the meeting were "Air Terminals" and "The Model Airway" Mr. Archibald Black of Garden City, N. Y. aeronautical engineer and chairman of the Safety Code Subcommittee for Maintenance and Equipment of Airplanes, addressed the meeting on the subject of landing fields for both airplanes and seaplanes. Mr. Arthur Halstead, Bureau of Standards, Washington, Assistant Secretary, Sectional Committee for Aeronautical Safety Code, spoke on landing fields and seaplane stations, with particular reference to the city of Philadelphia. Captain Burdette S. Bright, U. S. Army Air Service from the War Department, Washington, showed for the first time the new moving picture of "The Model Airway".

The meeting was attended by Vice-President B. H. Mulvihill, Conway W. Cooke, Chairman, Membership Committee, and C. T. Ludington, of Philadelphia all of the National Aeronautic Association, and jointly with the Engineers' Club and Aero Club, steps were taken to form the Philadelphia Bureau of the National Aeronautic Association, the

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Bureau to be made up of delegates from the Boards of Trade, Chambers of Commerce, Civic Clubs, Engineers' Clubs, Manufacturers' Clubs, the Aero Club, and representatives of the city government. With such backing it is believed that a model airport will be established in Philadelphia within the next twelve months, this airport to accommodate land planes and seaplanes, and have available space for the erection of a mooring mast for rigid airships, when such ships are placed in commission in this country.

Contest Committee N.A.C.A.

Announcement is made by the National Aeronautic Association of the U. S. A. of a special meeting of the Contest Committee of the Association which discussed the details of next year's Pulitzer Cup Race. The most important facts brought out, included a statement by Commander Jerome Hunsicker, of the Navy's Bureau of Aeronautics, that in tests in England, it has been established that the human system cannot withstand the strain of a turn in which the centrifugal force is greater than four times gravity. This is caused by the heart action being insufficient to force the blood to the brain when this great force has been experienced.

Inasmuch as a violent turn of 90 degrees at a speed of approximately 200 miles an hour, causes a centrifugal force of approximately three times gravity, it was felt that the danger line was being approached, to such an extent that a double pylon turn was essential for the safety of the pilot. Therefore, it was decided that the distance and pylon arrangement of the course for next year's race should be a total length of 200 kilometers, with four laps around a 50 kilometer equilateral triangle, using two pylons at the turns instead of one, assuring a wide turn.

It was also decided to have a single basis for the minimum factor of safety for monoplanes and biplanes, and seven and a half was decided as a satisfactory factor of safety for all parts of the planes.

The maximum landing speed, after due consideration, was decided upon at 75 miles an hour limit, being the same that was used at the 1922 Pulitzer Races last October at Detroit. However, the minimum high speed under which a plane could enter the race was increased to 175 miles an hour. In other words, a plane not capable of flying faster than 175 miles an hour, or nearly three miles a minute, is not fast enough to maintain its position in the race.

A restriction was placed on the contestants, in that they must retain the landing gears originally used. While retractable landing gears will be allowed, no contestant will be permitted to drop his landing gear after once taking the air.

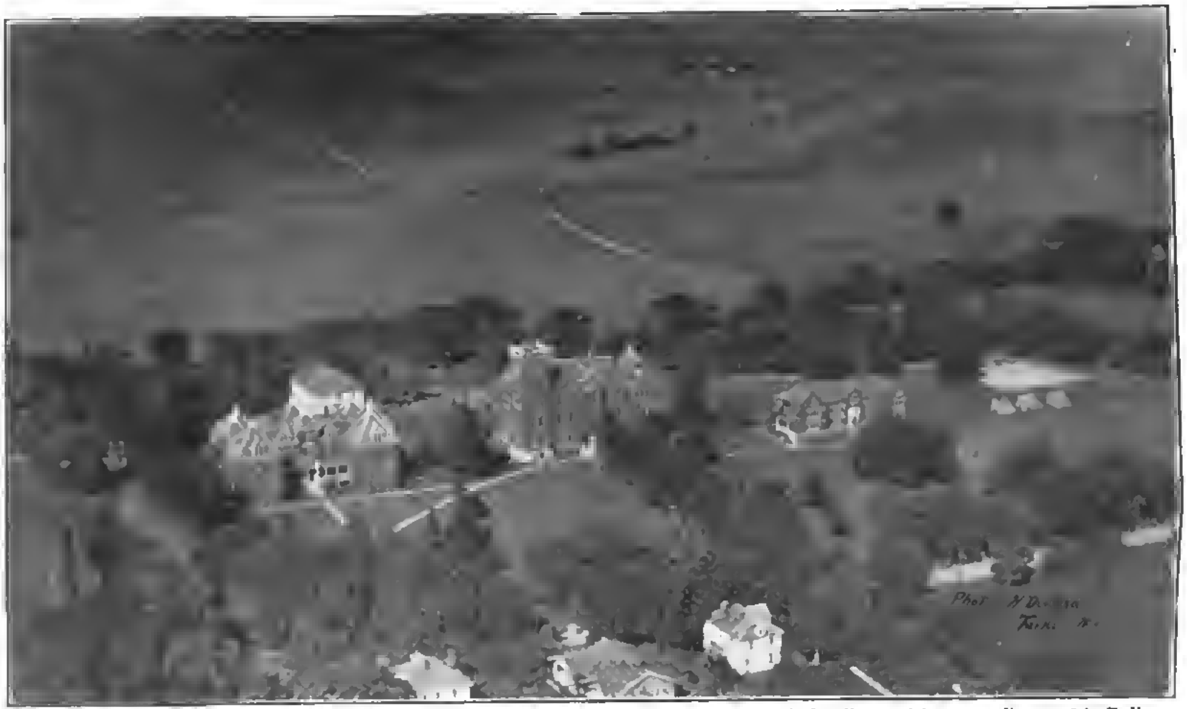
After the experiences at Omaha in 1921 and at Detroit in 1922 it was the consensus of opinion among the committee that the courses to be flown should be over water if possible.

Delegates from the various interested organizations were as follows:- Lieutenant Col. Frank P. Lahm, Chairman, Contest Committee; B. Russell Shaw, Executive Vice Chairman, Contest Committee; B. H. Mulvihill, First Vice President; and Col. H. E. Hartney, General Manager; all of the National Aeronautic Association of U. S. A. The airplane industry was represented by:- Mr. F. H. Russell, President Curtiss Airplane & Motor Corporation; and Commander C. G. Peterson, Wright Aeronautical Corporation; The National Advisory Committee for Aeronautics was represented by its Executive Officer, Dr. George W. Lewis; the Navy's Bureau of Aeronautics, by Commander J. C. Hunsicker, and Commander M. A. Mitsher; the Marine Corps Aviation Section by, Col. T. C. Turner, and the Army Air Service by Major Horace M. Hickam, Major H. A. Dargue, Major I. A. Rader, Captain St. Clair Street, Lieut. A. J. Maitland, (winner of the 2nd Pulitzer Race at Detroit), and Lieutenant T. J. Koenig.

Among the deliberations of the Committee, it was decided that prize money should not be offered for events in which only the Military and Naval Service planes could compete, as for example, the Pulitzer Race. It was suggested that certain sums of money be appropriated for the entertainment of service pilots and to assist them in defraying their expenses, and that at least two events be placed on the program eliminating Government planes and allowing the competition of civilian entries.

While the location of the contest for the Pulitzer Cup Race for 1923 has not been decided upon, a sub-committee was appointed to view localities considered desirable to conduct the races, and representatives of the Army and Navy Air Services will send their representatives on the tour of inspection with the National Aeronautic Association Sub-Committee.

Chicago, St. Louis, New Orleans, Omaha, San Francisco, Los Angeles, and Milwaukee have presented bids for the race, but the selection of the city will be left with the Sub-Committee.



Tarkio College, Tarkio, Mo. Photographed by C. Howard Duncan from a Laird Swallow with an ordinary 3A Roll Film Graflex

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Mapping Chicago

The Diggins Aerial Photo Co., has secured a contract to map the district bounded by 26th and 43rd streets and South Park avenue and Clark street Chicago. Work will begin as soon as the weather clears up sufficiently to insure clear pictures.

Model of Giant Airplane

An accurate flying scale model of the huge Zeppelin-Staaken commercial monoplane is on display at the Chicago Aero club rooms in the Auditorium hotel. The model was made by Paul Schiflersmith of the Illinois Model Aero club. The plane it represents is an immense all-metal monoplane with four 250 H. P. Maybach engines built right in the thick wings. The plane has a capacity of 18 passengers.

Huff Daland Aero Corp. Closes Western Office

The Huff Daland Aero Corporation has temporarily closed its western office at 1018 Commerce Bldg., Kansas City, Mo. during the winter months and will carry on its sales work at the Huff Daland Factory in Ogdensburg. N. Y. until the spring flying season commences.

The parent company has been intensively occupied with the development of Army and Navy airplanes ever since the production of their first thick wing biplane in the early fall of 1921, and the advent of the Petrel, the first successful cantilever biplane to be placed upon the commercial market in the United States which made its appearance in the spring of 1922.

The Petrel was quickly followed by the Lawrance motored TA-2 training plane, produced for the United States Army, and the HN-1 training and gunnery seaplane powered with the Wright E-2 motor and developed for the United States Navy.

Both types were completed and fully flight tested during the past summer, the HN-1 being delivered by air on its maiden flight along the all water route from Ogdensburg to Washington, D. C. during the latter part of August, and the company was rewarded in both cases with additional orders for ships of the same general class resulting in the present construction of the HO-1 and TA-6.

Huff Daland & Company is now calling together the men who handled its sales work and commercial flying during the past year with a view to collaborating with them upon the results of the year's flying and completing the "Petrel" for 1923.

American Investigation Corp.

The American Investigation Corp. is proceeding conservatively upon a progressive line of inquiry which assures a substantial structure of information. This investigation includes such vital subjects as the kind of gas to be used and the manner of its production, what, when and where to construct, and a survey through independent sources of probable revenue from the transportation of freight and passengers.

Lawrance Engine Test

Following the excellent showing made by the 200 hp. Lawrance model J radial air-cooled engine in the last Curtiss Marine Flying Trophy race, the winner of which was equipped with this power plant, it is interesting to hear that in a recent endurance test this engine ran for over 200 hrs.

The exact figure was 201 hrs. the last 36 hrs. of which were a continuous run, no stops or adjustments of any kind being made. This last run is the longest on record for an air-cooled engine. The 201 hrs. of running was accomplished without overhaul of any kind, without the change of any of the accessories, including magnetos, spark plugs and wiring. At the end of the run all bearings and bearing surfaces were in excellent condition, barely showing any sign of wear.

For the total run of 201 hrs. the engine developed an average of 182.7 hp. at approximately 1705 r.p.m. with an average gasoline consumption of 0.501 lb. per hp. hr., and an average oil consumption of 0.019 per hp. hr.

A 300 hr. full throttle endurance test is shortly to be begun with a Lawrance J engine fitted with valves of a new type.

New Airplane Co.

A company to manufacture Bellanca airplanes from designs of Prof. J. M. Bellanca has been organized under the name of Roos-Bellanca Airplane Co., Omaha, Neb.

Prof. Bellanca is internationally known as an aeronautical engineer, airplane designer and constructor, whose activity in the field began in 1906. Victor H. Roos, organizer of the company, is a prominent Omaha business man and is one of the largest dealers in motorcycles and bicycles in the middle west.

The first model to be produced will be the Bellanca CF monoplane. It is expected that production of this model will soon be under way and that it will be possible for the company to begin deliveries about June 1923.

International Air Exposition at Gothenburg

The Swedish Government representatives in the United States advise us that the International Air Exposition to be held in Gothenburg, Sweden July 20—August 12, 1923, has attracted important exhibitors from England, France, Germany, Holland, Italy, Czecho-Slovakia, Norway and Denmark. Participation by the United States is greatly desired. Full information, with descriptive booklets, etc., will be sent on request by the Aeronautical Chamber of Commerce.

British Governor Christens American Flying Boat

The christening ceremony of the latest flying boat of the Aeromarine Airways Inc., which has been specially detailed for the Miami-Nassau air service, was performed recently when His Excellency Major Sir Harry Edward Spiller Cordeaux, K. C. M. G., C. B., Governor of the Bahamas formally gave his name to the craft in Nassau Harbor.

According to C. F. Redden, President of the Aeromarine Company with executive offices in the Times Building, New York, Governor Cordeaux broke a bottle of champagne; which was tied with the international colors, red, white and blue, over the bow of the beautiful craft with the words, "I name this flying boat the 'Cordeaux' and trust that under the guiding hand of Providence she may make many successful trips".

Thousands of people watched the ceremony. A guard of honor from the Bahama Police under the Acting Commandant, C. J. Whebell, was drawn up opposite to the landing and the band played the Royal Salute on

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the arrival of the Governor, who was accompanied by Lady Cordeaux, Roland Rohlfs, Manager of the Miami Division of the Aeromarine Airways, who came over to attend the christening ceremony, Honorable H. E. W. Grant, C. M. G., Colonial Secretary, the Honorable P. W. D. Armbrister, Receiver General and Treasurer, the Hons. Sir Jas. P. Sands, G. H. Gamblin, G. H. Johnson, J. R. G. Young, Members of the Executive Council, the Honorable Harcourt Malcolm, C. B. E., K. C., Speaker of the House of Assembly, the Hon. Lorin Lathrop, American Consul and Mrs. Lathrop, Kenneth Solomon, Chairman of the Development Boards, Miss Moseley, Editor of the Nassau Guardian, Mrs. Boyce, wife of the American Vice Consul and Sidney Farrington, Late Royal Air Force, and local agent for the Aeromarine Company.

In a speech after the ceremony, Governor Cordeaux expressed what great pleasure it had given him to accept the invitation of the Aeromarine Airways to perform the naming ceremony of their latest and most-up-to-date aircraft. It was always a pleasure for him to lend his aid to any enterprise which would benefit the Colony. Few among them would have any doubt that the institution of a regular air service between Nassau and Miami would greatly facilitate relations with their friends and neighbors across the Gulf Stream. He would not care to be associated with any enterprise which was not entirely sound and reliable but in this instance he had not the slightest hesitation in accepting the compliment which the Aeromarine Airways had paid him by suggesting that their craft should bear his name.

The 11-passenger Aeromarine-Navy flying boats operated in the Southern Division during the Winter months are overhauled each spring, used in our Northern operations around New York, Atlantic City, Cleveland and Detroit, and then given another overhauling in the Fall and placed in the Florida-West Indies service during the Winter.

On the Great Lakes Division a rigid schedule was maintained, boats arriving and departing on the minute. There were no forced landings and no mishaps during the entire season. Considerable freight was carried including a Ford automobile (knocked down). This is the first time an automobile has been carried by aircraft.

Contrary to the general impression of the public that Commercial Aviation in Europe has far surpassed American progress, the performance mentioned in the foregoing surpasses European records in the following particulars:

1. Safety of passengers
2. Comfort and convenience of equipment
3. More rigid observance of flying schedule
4. Smaller number of forced landings

Due to the record established for safe operations, insurance underwriters are now insuring our passengers against accident at a very low rate.

An Aeromarine Airport has just been opened at San Juan, Porto Rico, and in January a line will be established between San Juan and Kingston, Jamaica, connecting with Key West and Havana.

It is expected that several new routes will be opened during the new year. Those now under consideration are: New York to Southampton, Newport, Providence and Boston; and on Lake Michigan out of Chicago.

ARMY and NAVY AERONAUTICS

An Aeronautical Museum at McCook Field

Within the course of the next few months there will be opened at McCook Field, Dayton, Ohio, a Museum containing a most unique collection of various types of airplanes and aircraft engines. It will occupy four new buildings at the extreme north end of the field, having a total floor space of 24,600 square feet. The collection of the exhibits was started during the war, and includes airplanes and engines of American, British, French, Italian, and German design. The more successful and widely-known productions of later designs have been added as they were developed, consequently a fairly comprehensive idea of the course of the development of the present-day airplanes and aircraft engines may be gotten by a careful study of the various displays.

The great value of the Museum, however, will be that it will afford a means of obtaining accurate and detailed information concerning the design features of a large number of different types of airplanes and aircraft engines, which is required by those interested in working out new designs. On account of the inaccuracies and omissions of important details, which frequently occur in written descriptions, mistakes in design are often made, or it is found necessary to duplicate costly and tedious experiments. Even if the airplane or engine is available for inspection, it is not possible to determine the details of construction of certain parts such as wing ribs, contours of cams, etc., unless they are completely disassembled, which is impossible in the majority of cases. The method of display used in the Museum will entirely eliminate this difficulty, and therein will lie its great value.

In the engine department, which occupies one entire building, there are displayed 63 different types of engines. Among these are included engines having from 2 to 18 cylinders of both air and water-cooled types. Engines with radial, all-in-a-line V-type, and opposed arrangements of cylinders are represented. Two engines of each type are shown. One is completely assembled and mounted on a stand. The other is entirely disassembled, the small parts being placed in cabinets with glass doors, and the larger parts on an open shelf, just under the cabinets. Duplicate parts are stored in closets under the shelf. These parts may be borrowed for use on engines in service at McCook Field by filling out loan cards, which on many occasions will result in a great saving of time and expense. Every part is thus available for inspection and measurement, while the assembled engine furnishes an opportunity for the designer to obtain first-hand information as to their relationship and method of functioning. The cabinets are arranged in six rows across the engine building. Library tables and chairs are placed conveniently near them, and bound

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The New Navy airship Type J, built by the Goodyear Tire & Rubber Co. at Akron

documents containing very comprehensive data on all engines exhibited may be obtained from the office in the building.

An aeronautical engineer of wide practical experience will be in charge of the exhibits, and will gladly render every possible assistance to prospective designers and others interested in aviation in securing any available information.

The airplane exhibit includes types of bombardment, training and pursuit airplanes of both foreign and domestic design. These are so arranged that a comparison of the airplanes used by the different countries for the same purpose can be easily made. Certain of the more widely used types of U. S. Army airplanes are completely assembled and fully equipped with navigation instruments, armament, landing lights for night flying, etc. Various special features of the airplanes and their equipment are described on placards. Bound documents are also available containing detailed information relative to their design and performance.

The wings of the disassembled airplanes are mounted in wing racks alongside the fuselage. The fabric is removed from one of them in order to allow an inspection of the spars, ribs, etc. The other wing is left intact to give an idea of the completed part. Various types of landing gears are also shown disassembled, thus making it possible to easily observe the details of their construction.

The Museum can undoubtedly be a great aid to the engineers of the U. S. Army Air Service, and it is hoped that they will avail themselves of its every facility. Manufacturers of airplanes, aeronautical engineers engaged in civil practice, and others interested in the science of aviation will also be welcome, and the resources of the Museum placed at their disposal.

Progress of Lighter-than-Air Training at Scott Field

The course of instruction in airship piloting for student officers and cadets at Scott Field, Belleville, Ill., has been progressing rapidly. The A-4 a one-man control ship, is being used for this purpose. The ship has been kept busy giving one-man flights to those students of the Balloon and Airship School who finished their primary airship ground training at Ross Field last summer. The Pony Blimp has been used for practice flights by qualified airship pilots at the Post.

Airship Hangar at Scott Field Completed

The new airship hangar at Scott Field, Ill., is about ready to be turned over to the Government. The work is entirely completed with the exception of a small block of concrete in front of the south door. The hangar has been used for the past two months for housing the Pony Blimp, the A-4 and Captive Balloons.

The hangar is about the second largest in the United States, costing more than one million two hundred thousand dollars.

Fast Dirigible Put in Commission at Scott Field

The SST-3, or "Mullion", a non-rigid-two-man control airship, which has been set up at Scott Field, Belleville, Ill., under the supervision of Lieut. Frank M. McKee, with Technical Sergeant Olin Brown in charge, has been air tested and found in good condition. This ship is one of the original English bags, and is inflated with hydrogen. It is one of the submarine scout type which was used extensively by the British in 1918 for "spotting" submarines.

The SST-3 is one of the fastest of the Army dirigibles, with a maximum speed of 57.5 miles per hour. It uses two four-blade propellers, driven by two Rolls-Royce "Hawk" type motors, developing 150 horsepower. It is 165 feet long, 49 feet high, 32½ feet wide, and has a gas capacity of 100,000 cubic feet. The useful lift of the ship is 2240 lbs., and its weight is 4,750 lbs. The car is designed for 5 passengers, including the pilots and engineer.

The peculiarities of its construction are the lightness of the bag, which is made of very thin two-ply fabric, and the fact that it has no upper stabilizer.

This type of airship carries 240 gallons of fuel in the four 60-gallon tanks attached to its sides. This amount of fuel is sufficient to keep the ship in the air 12 hours. It has a cruising radius of 690 miles.

The SST-3 will be used for training purposes by the Air Service

© U. S. Navy Photo
New Principles of Construction feature this plane designed and built by C. F. Rocheville A. C. M. M., (U. S. Navy) in his spare time while on duty at the Naval Air Station at San Diego. A combination of high air speed and low landing speed is accomplished by a "variable camber" wing.

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Balloon and Airship School at Scott Field.

Another Non-stop Transcontinental Flight

The "Cloud Duster," a special biplane equipped with a Liberty twelve, and built by Messrs. Davis and Springer in Los Angeles, Calif., is now at March Field, Riverside, Calif., preparing to hop off on a non-stop flight to the Atlantic Coast. The exact date of the attempt is not known, but the local papers report that it will be made during the next full moon. Messrs. Davis and Springer are well-known airplane designers and builders, and we all wish them the greatest success.

Air Service Reserve Officers Purchase Airplanes

Many Reserve aviators, commercial pilots and others are taking advantage of the sale of "Jennys" (JN4D's) at the Rockwell Air Intermediate Depot, Coronado, Calif., and the lower end of the line resembles the test field of a wartime aircraft factory. Flyers from points as far away as Wyoming and Louisiana have bought planes, set them up and started on their homeward journeys. All day long, including Sundays, there are "Jennys" buzzing around on their initial flights and trials, making ready for the "cross-countries" to their future homes.

A Meteorological Station for Scott Field

A new meteorological station is being installed by the Government at Scott Field, Belleville, Ill., at a cost of approximately $3,000, exclusive of the cost of the instruments. This will be one of the most complete of the Air Service meteorological field stations, and will furnish data daily by radio to Selfridge Field, Chanute Field, and to the Weather Bureau at Chicago.

Among the new instruments to be used in this station are the telethermoscope and the Carpenter hythergraph.

Captain Lawrence F. Stone, Post Meteorological Officer, will direct the operation of the new station, with Sgt. W. G. Wills in charge.

Inspector Geo. J. Brands, of the Meteorological Signal Service, is expected to arrive from Washington to inspect the new station as soon as it is completed, which will be about November 25th.

Airship Tows Another One

An interesting experiment was performed recently at Scott Field, Belleville, Ill., with the Airship A-4 and Pony Blimp. The Pony Blimp, with its motor dead, was attached to the A-4 with a 500-ft. ¼-inch rope and was towed by the latter ship for about ten miles. A safe landing was effected with the ships thus attached.

Lighter-than-Air Activities at Langley Field

The Airship C-14 recently made three successful flights, with a total of 3 hours and 50 minutes in the air, after a period of idleness for nearly two months while undergoing repairs. The ship subsequently made another flight of two hours' duration.

A free spherical balloon, piloted by 1st. Lieut. A. J. Etheridge, A. S., left the hangar at 10 a. m. on December 7th. and landed at 2:50 p. m., having traveled approximately 50 miles.

The Military Airship A-6 is being inflated with helium for experimental purposes.

Dayton Chamber of Commerce Honors Major Bane

Members of the Chamber of Commerce of Dayton, Ohio, recently tendered a farewell dinner to Major Thurman H. Bane, Army Air Service, former commanding officer of McCook Field, who was retired from active service.

Addresses were made by Mr. Robert Elder, President of the Chamber of Commerce; Major L. W. McIntosh, Commanding Officer of McCook Field, and Major Bane. Mr. C. F. Kettering acted as toastmaster. Mr. Elder presented Major Bane with a gold watch and chain as a token of the esteem of the people of Dayton.

Among the many guests present were Orville Wright, pioneer aviator, Major A. W. Robins and his staff from Wilbur Wright Field, and department heads of McCook Field, etc.

The principal topic of the evening was the establishment of the new airdrome in Dayton.

New Airplanes for the Chief of the Air Service

Three more special DH4B Messenger Airplanes are nearing completion for the use of General Patrick. These airplanes are all of natural finish, having 135 gallon capacity gasoline tanks which are especially adapted for extended cross-country flights. The first one of this type, which was completed early this fall, was delivered to General Patrick, who was very much pleased with the design and workmanship. He demonstrated his appreciation by having his picture taken with a group of the mechanics who built the ship, using the airplane as a background.

Hydrogen Gas To Be Manufactured at Scott Field

A new hydrogen gas plant is being put up at Scott Field at a total cost of approximately $250,000. The equipment of the plant is being furnished by the Government, and the W. M. Sutherland Construction Company, of St. Louis, has the contract for putting up the buildings.

The plant will consist of two separate gas manufacturing units—one makes gas by the oil cracking process and the other makes gas by the electrolytic process. This plant will make a total production capacity of 6,000 cubic feet of gas per hour.

An Ingenious Device for Testing Engines

A London newspaper tells of a remarkable "Safety First" device now in operation at the Croydon Airdrome—a dynometer plant for testing airplane engines. After approximately every 100 hours of running, engines are taken out, placed in this machine, and submitted to every test and strain which the engines have to undergo in actual flight.

Indicators register minutely the flow of petrol through the carburetors; if they do not synchronize, the fault in the jets or carburetors themselves is searched for and remedied. Thermometers register even the temperature of the lubricating oil entering and issuing from the engine. Finally, the whole engine is dismantled and submitted to a thorough examination for partly worn parts. By this method no fault, however trivial, can escape notice.

The plant, installed by the Daimler Air Service, is claimed to be the only one of the kind used on any air station in the world. It is held responsible for the fact that, since the line opened in May last, only two forced landings have occurred, one of these not having been caused by engine failure.

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REVIEW of WORLD AERONAUTICS

The International Air Congress

A strong Executive Committee under the Chairmanship of Major-General Sir F. H. Sykes, G.B.E., K.C.B., C.M.G., M.P., has taken in hand the organization of the International Air Congress which is to be held in London from June 25th to 30th next year. National Committees have been formed in several countries to prepare lists of names for Membership of the Congress, and in other countries lists are being obtained through the Aero Clubs or other representative bodies. Membership is limited to those countries which are members of the Federation Aeronautique Internationale or signatories of the International Air Convention. The subscription is to be £1 (or its equivalent in foreign currencies) for a Member, and 10s. 0d. for an Associate Member who must be a member of the family of a Member. The papers to be read are divided into four Groups, which will hold Sessions simultaneously, and will cover every aspect of the subject from fundamental scientific problems to such matters as passport regulations and the organization of an aerial transport company.

Gibraltar as an Aeronautical Base

The Spanish review Atlas has recently published the outline of a project which has been attributed to the British Air Service. This project contemplates the transformation of Gibraltar in such a way as to make available there the strategical advantages offered by aerial armaments.

The French review L'Aeronautique publishes two drawings which are part of a documentation of this project which has been examined by that review, which however does not stand responsible for the authenticity of such documents.

According to the documents examined by L'Aeronautique, it is contemplated by the British military authorities to establish at Gibraltar an underground aeronautical basis capable of accommodating a considerable number of aircraft and balloons, one dirigible of large dimensions and all repair shops and living quarters for the personnel which shall be needed for the upkeeping of such a large quantity of flying machines.

A number of underground airdromes located at various depths and equipped with electrically operated elevator platforms (some of which as large as 165 feet in diameter), would be used for storing up and bringing up and down the aircraft as it is needed.

Each underground level would have a number of tunnels all leading radially to the plane of the elevator platform—these tunnels to be orientated in the direction of the known periodical winds blowing in that region. Each tunnel would lead at one end to one point or another of the promontory and the outlet of these tunnels would be equipped with a door rotating around an horizontal axis perpendicular to the axis of the tunnel over which the aircraft must pass when getting in or out the tunnel—these doors to open at any desired angle with the axis of the tunnel (this angle to be a function of the speed of the wind and of the speed of the aircraft when either landing or taking off), would act in the same way as a landing platform on an aircraft carrier ship and the same system used on these ships for checking the speed of a landing aircraft would be used in connection with these doors.

These doors would be well camouflaged so as to prevent their being located from the air by an enemy aircraft and furthermore, the outlet of the tunnels would be protected by the anti-aircraft guns of the fortress.

In this project, it is reported that hydroplanes would be brought from the different underground levels to the sea level and vice-versa through a system of locks and canals. Supplies of fuel oil, etc. would be kept up to the storage capacity needed, by submarines and ships.

If we consider that the ground which can be used for the realization of this project is about 3000 feet in diameter and rises above the sea level to a maximum altitude of 1000 feet, the project attributed to the British Government does not seem to be an impossibility, at least as far as space requirements are concerned.

If this project should become a reality Gibraltar would become a most powerful fortress possessing a firing range equal to the flying range of its aircraft and a tremendous help for a naval fleet. In fact, Gibraltar would become an enormous stationary aircraft carrier, defying the torpedoes of all ships and submarines of an enemy fleet.

The Italian Air Routes

Italy is a mountainous country; besides it is very small in size compared with the United States. Rome the capital is right in the center of the territory, which is constituted by a peninsula and two isles.

Night trains leaving Rome at 8 p.m. reach the northern or southern border the next morning. It is very hard therefore, to establish an air transportation service which would compete with the railroad.

However, a definite programme of the Italian Air Routes has been laid, using the same routes which were employed during the war to send the aircrafts from the factories to the front line.

The air routes follow the valleys and the coasts in order to avoid the mountains. They cross the Apennines mountains only in two points.

The total mileage of the air routes will be about 2400 miles, as follows: Nice—Rome—Foggia—Brindisi, 700 miles; Udine—Bologna—Foggia, 500 miles; Turin—Milan—Trieste, 320 miles; Milan—Sarzana, 120 miles; Piacenza—Bologna, 100 miles; Innsbruck—Verona, 150 miles; Campiglia—Cagliari, 300 miles; Naples—Catania, 250 miles.

London-Berlin Aerial Air Line May Suspend

The new commercial air service connecting London, Cologne and Berlin will be suspended soon despite its financial success unless the Air Ministry and the German Government reach an agreement.

A clause in the treaty which gives the Allies unrestricted right to fly over Germany lapses at the end of the year, and Germany has intimated her intention to refuse to allow British commercial airplanes this privilege unless the construction restrictions imposed on her by the treaty are ameliorated.

The Daimler Airway Company thinks it has solved the difficulty by an agreement with German commercial firms which have permission from the Government to operate air liners direct. But the Napier-Instone line via Cologne, which was inaugurated October 1, fears that it is doomed. Air authorities here generally are in favor of Germany having a free field for development because of the vast possibilities for commercial traffic, but they have no hope of altering the treaty.

New Aeroplanes for Siamese Postal Service

The Siamese Government is to purchase nine new aeroplanes to cost about $103,400 at the present rate of exchange for use in the Postal Service, says Consul M. P. Dunlap, in a report to the Department of Commerce. Although authoritative information has been received as to this contemplated purchase no specifications or tenders for bids have as yet been issued. A committee of Siamese aero experts is to decide on the purchase and since these men have been educated in France it was intimated that they would undoubtedly choose French machines. However ar-

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rangements are being made through the Siamese Legation in Washington to send students to the United States to receive training in aerial navigation and this will naturally bring Siamese authorities in closer touch with American-made equipment.

Caproni Building New Plane

The Caproni Company of Italy is building another giant flying boat to replace the craft that was last year torn from its moorings during a severe storm and totally wrecked. The ship now under construction is of practically the same dimensions, being 74 feet in length and having a span of 98 feet. It carries 100 passengers and weighs, loaded, 49,200 pounds. Its weight empty runs up to 27,200 pounds. The plane is to be powered with eight Liberty engines, giving it a total of 3200 H. P. To insure safety, the hull is divided into 10 water-tight compartments.

Mail Service by Air From Cairo to Bagdad

The most picturesque of the regularly traveled air routes and the one richest in historical associations is undoubtedly the 864 miles that separate Cairo, the capital of Egypt, from Bagdad, the principal city in Mesopotamia.

In one day the fliers of the British Royal Air Force go from the Land of the Pyramids over the Holy Land and across more than five hundred miles of desert to the Land of the Date. All of these countries were the scenes of early civilizations, and the planes carry the letters of European and American business firms over ruins that are four thousand years old.

The most difficult part of the journey is the 532 miles of desert that stretch between Palestine, or rather Transjordania, and the capital city of the land from which our dates come. There are practically no natural landmarks in all of this distance; it would be comparatively easy, however, to navigate this by compass, but the risk of forced landings can never be eliminated, and the problem was to provide some sure means by which help, if necessary, could be provided for the stranded airman.

This problem was solved by running a number of motor trucks and automobiles over the same track across the desert and marking off a series of possible landing places that will act as a guide to a pilot and enable him to be located by wireless in the event that he has been compelled to come to the ground.

Only this narrow track—two parallel lines five or six feet apart—is the fliers' navigating chart. On favorable ground it is easy to see it even from 8,000 feet aloft but, as may be imagined, it is none too easy to pick up without some indication as to its locality, nor is it a simple matter to follow it when found, if the nature of the ground has prevented vehicles from making more than a slight impression on the surface.

On some places a single track has been reinforced by a number of separate tracks where the cars and trucks spread out instead of following one another, but for the most part the task of the airman is to hold grimly to the single narrow streak. Should he lose sight of it at any time, there is nothing for him to do but to circle around in the air or to retrace his course until the track has been picked up again.

One additional danger the fliers of the Royal Air Force face on this journey—there is always the possibility that some desert dweller who nurses an antipathy to the British may take a shot at a low-flying plane or that the airman, if forced to descend, will encounter hostile tribesmen. However, the nomads of this district have been inclined to friendliness through the action of the Force in picking up and flying to Bagdad with a wounded sheik found in the desert and in procuring for him the medical treatment that saved his life.

But the fliers, when they are prevented from making the trip in a single day and are forced to land in the desert, are still suspicious of the natives. On one occasion a pilot, making a forced landing, was approached by a number of Arabs whose attitude was expectant rather than friendly. The man knew some Arabic and the following conversation took place:

"Are you alone?"

"No."

"How many other airplanes are there?"

"Ten."

"Are they coming here?"

"Yes."

"Have you told Amman (the nearest city) you are here?"

"Yes."

Convinced by these answers the Arabs allowed the engine defect to be remedied and the plane continued on its lonely journey to the date palms of Bagdad. Whether the tribesmen would have adopted a different attitude if they had known the answers to their inquiries were all untruthful is a matter that must remain doubtful. The pilot himself is thoroughly satisfied with the outcome of his adventure and has no desire to pay the nomads another visit to find out the answer.

Air Navigation in Holland

During the summer service the Royal Aerial Company of Holland on the Amsterdam-London and Amsterdam-Brussels routes carried 995 passengers, 803,251 letters, 1,672, 555 parcels, and 62,889 kilos of cargo. In addition, 2,582 passengers were carried on short pleasure trips in Holland.

The service to London is proving a great boom to Dutch flower growers and to the British newspapers. In June and July this year 3,837 kilos of fresh flowers were carried to London and 10,016 kilos of English newspapers to Holland. The total distance flown by the company's machines is now over 1,200,000 k.m., and not a single accident has occurred.

The fares have now been reduced considerably and are only slightly higher than those of the fastest steamship services. The fleet of the company consists of Dutch-built Fokker machines, which have proved reliable and stable.

New Spanish Factory

The Hispano Automobile Co. has erected a special factory at Guadalajara within the past year for the manufacture of airplanes. Planes have been constructed along the lines of certain Handley-Page models, under the supervision of a British advisor, who was recently replaced by aeronautic advisers and technical experts of the Spanish Army. About 60 planes have been built for the Spanish Army up to date and orders on hand call for 30 new ones and 15 replacement planes. These airplanes measure 17 meters from tip to tip (55.7 feet) and use 300 h. p. Hispano-Suiza motors, built in Paris at the factory of that name. Spanish material is being used in nearly all parts of these airplanes, which sell for about 35,000 pesetas.—Commerce Reports.

Production in Finland

The first Finnish airplane factory at Sveaborg has two monoplanes ready for assembly. The wings are placed under the fuselage, giving the pilots a clear upward view, which is considered of great value. The planes are finished with 6-cylinder 300 h. p. Fiat motors, purchased in France, and when completed will weigh little more than 2,000 kilos. The factory has a staff of constructors and draftsmen in addition to 60 professional workmen, and has a capacity of 30 planes per year.

Syrian Air Routes

The Syrie-Liban Aero Club, recently formed with the object of developing aviation in Syria, is to be affiliated to the Aero Club of France, and a certain liveliness in aviation matters may be expected in this country in the near future. The French Air service have already organized 50 landing stages, 10 of them fully equipped as regards shelters, revictualling and repairing arrangements. The principal lines thus prepared are Alexandretta, Aleppo and Deir-ez-Zor on the route to Bagdad; Aleppo, Hama, Homs, Rayak and Damascus, towards Palestine and Egypt; Damascus, Palmyra and Deir-ez-Zor, for the direct crossing of the Syrian desert in four hours; Alexandretta, Latakia and Tripoli for the coastal line.

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ELEMENTARY AERONAUTICS and MODEL NOTES

Gliding and Soaring Flight

(Concluded from page 614)

NO limit seems to exist for the variety of sailplanes. The size appears more established. Wing spans of about twenty to thirty feet are frequent. But the selection of a wing curve and the shape and disposition of the surfaces leaves one in doubt. Tandem planes, tail-first planes, monoplanes and biplanes have given surprisingly good results. Looking over the field, it would appear that the monoplane is most suitable for sailing flight.

The advantages of the monoplane construction are numerous. First, there is simplicity. This item is of extreme importance, especially in the experimental stage. Monoplane wings may be built easier and more quickly, thereby saving much time and expense. Aerodynamically the monoplane is more efficient—greater lift is derived from it and lift is one of the prime requisites of the "sailplane". Upward trending air currents are utilized by the monoplane wing to best advantage. Of course the best example of monoplane structure is found in the birds whose example the gliding pilots hope to follow.

Ease of lining-up and taking down are other points in favor of the monoplane. With some of the thick wing sections being employed it is possible to incorporate some of the body structure at the wing-roots, which reduces head resistance and permits a better flow of air at the juncture between wings and body.

At present it is natural that a large per cent of sailplane designs follow the general outlines of powered aeroplanes. A good number, of course, resemble nothing ever conceived before, but it is noticeable that the more conventional types have proven more satisfactory. As the art of sailplane design improves, however, it is likely that forms of structure will depart radically from the powered plane, for the sailplane must fulfill an entirely different set of conditions than that of the aeroplane.

Model Gliding Tests in England

The Society of Model Aeronautical Engineers in London, England, have carried on some unusual contests which should prove of interest to our American model builders. Competitions are held for "Kite-launched" model gliders. By this system, when the model has reached its greatest height, as limited by the length of the towing line about 150 feet long, the model is automatically released and a free glide follows. Glides as long as 57 seconds in duration have been made. On a 100-foot line, one light-weight glider stayed aloft for 25 seconds.

The Enclosed Motor Model

The flying-stick model driven by rubber strand motive power reaches its neatest state when the strands are enclosed in the framework. The usual manner to accomplish this is by using a V-shaped stick, a stick of square section, a round or oval section, hollow in every case and preferably tapered toward the ends.

As distance models have about reached their limit in performance, the enclosed-motor model furnishes a good basis for new contests. Not that this type of model is unknown for it has always been a type chosen by those particularly interested in construction details. But it is a fact that models with plain chic framework have always taken the lead so far as records are concerned. Still there is the matter of appearance to be considered, and there is no question about the unsightliness of the rubber strands we use. If it were not for the fact that this rubber-strand motive power is the most efficient source of power for model aircraft, it would long since have been discarded because of its appearance.

As we must use rubber strands, the best we can do to "disguise" them is to enclose them in the framework. The result is a model which more nearly approaches the appearance of real full-sized aeroplanes.

The Clark Biplane Racer

By Jack Clark, designer and builder

The Clark twin-pusher biplane was designed primarily for spectacular flying, with a fair ability for distance. In biplane models there is more resistance to contend with but the stability and fine appearance are factors that make appeal to model builders. This biplane has several unique features as will be noted in the following data:

The frame is constructed of spruce main members, tapered from 1/4" semi-square in the center to 5/32" round at the ends. The

The Clark Biplane Racer

X braces and rear skid are of split bamboo. The Landing gear is formed of piano wire with fiber wheels provided with brass bushings at the hubs.

Wings are of the single-surfaced type, main spars of spruce, leading edges of 3/64" by 3/32" bamboo. Ribs about 1/16" square. Trailing edge of waxed linen thread. Interplane struts are 1/8" by 1/16" bamboo. All tension and bracing wires are of strong linen thread.

Fiber propellers are used, each driven by 16 strands of 1/8-inch flat rubber.

General Dimensions:

Length	42. "
Span, upper wing	40. "
Span, lower wing	30. "
Chord, both wings	4.5"
Gap	6.5"
Span, elevator	20. "
Chord, elevator	5. "
Dihedral	10 °
Propeller diameter	10.5"
Total wing area	387 sq. in.
Weight	8 oz.
Loading per sq. ft.	3 oz.
Stagger	1.5"

Three ounces may seem a very light loading but it must be considered that the model is a biplane and consequently the actual lift efficiency of the wings is decreased for the same area as a monoplane, due to resistance and interference. The gap/chord ratio is rather high—1.44:1 but for a model the increased lift from a high gap/chord ratio more than compensates for the increased resistance. The increase of G/CH increases the biplane reduction factor from 0.77 lift of monoplane area with $G/CH = 0.8$, to 0.89 Ky reduction factor with 1.6 G/CH ratio (*N. P. L. for full-sized planes*). Assuming the same rule to hold true for model biplanes the actual loading would be:

$$L = \frac{W \cdot 144}{A \cdot .87}$$, where L = loading, W = weight of model, 144 = 1 square foot area (represented in square inches) and 87 = Ky R.F. for G/CH ratio of 1.44, approximately,

A = 387, W = 8

$$\therefore L = \frac{8 \cdot 144}{387 \cdot .87} \text{ or } \frac{1{,}152}{336.69} = 3.42 \text{ oz.}$$

Theoretically, then, the loading is increased 0.42 oz. by using the same area in biplane form with G/CH ratio of 1.44. But the area of the elevator is 90 sq. in., hence the actual area affected by biplane form is:

387-90 = 297 sq. in. (297 x .87) + 90 = 338.39. In other words, 387 sq. inches of surface in monoplane form is equal to 338.4 sq. in. in a biplane with an elevator having 90 sq. in. of surface and in which the G/CH ratio is 1.44 in lifting value.

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A New Monoplane —The Bellanca C F

One day last June a monoplane was seen hovering over Omaha, Nebraska. It was the Bellanca C F on her first flight. And then—

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Important Announcement

The March issue of Aerial Age will be a special National Aeronautic Association Number. A score of distinguished Americans will contribute articles on every important phase of aeronautic development. Be sure your order for this issue is placed well in advance.

(*Concluded from page 77*)

constitution and by-laws, has five Governors-at-Large. They are: Governor-General Leonard Wood, U. S. Army at Manila, P. I.; Hon. Newton D. Baker, Ex-Secretary of War, Cleveland; Gould Dietz, Omaha, Nebraska; Hon. Wm. P. MacCracken, Chicago, Ill.; Wm. F. Roberts of the Bethlehem Steel Co., Sparrows Pt. Md.

The following committees also exist under the Association by-laws:—

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Soaring Flight Committee

Dr. George W. Lewis, National Advisory Committee for Aeronautics, Navy Department, Washington, D. C.; Orville Wright, Dayton, Ohio; Mr. E. T. Allen, Massachusetts Institute of Technology, Cambridge, Mass.; Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge, Mass.

Contest Committee

Lt. Colonel F. P. Lahm, State War & Navy Building, Wash. D. C.; B. Russell Shaw, 26 Jackson Place, Washington, D. C.; Porter Adams (Collier Trophy Committee) 1352 Beacon St., Boston, Mass.

Foreign Relations Committee

Frank Dickson, Packard Motor Car Company, Pittsburgh, Pa.

Membership Committee

The Membership Committee is composed of the nine District Vice Presidents, with Mr. Conway W. Cooke of National Headquarters, as Chairman.

In addition to the Committees enumerated above, there are now in formation the following committees: Executive Committee; Finance Committee; Industrial Research on Aeronautics Committee; Scientific Research on Aeronautics Committee; Air-ways and Operations Committee; Junior Activities Committee; and Women's Auxiliary Committee

---

In order to co-ordinate the activities of the various committees and to act as Executive Officer at the General Headquarters, under the Resident Vice President, the office of General Manager was created. The incumbent of this office is Lieutenant Colonel Harold E. Hartney.

Lieut. Colonel Harold Evans Hartney, is a graduate of Law of the University of Toronto, and the University of Saskatchewan in 1914, but within a year thereafter he joined the Royal Flying Corps, where he remained for two years. As Captain he received the Italian Silver Medal for Valor, and was transferred in September, 1917, with the rank of Major to the American Air Service. He organized, trained and took to the front, the 27th Aero Squadron. Colonel Hartney was with the 20th British Squadron, and although a double-seater squadron, is credited with more victories than any other Squadron in the British Air Force during the war. Colonel Hartney is officially credited with the destruction of six enemy planes and was in the first air battle of the war, at the first battle of the Somme. On August 21st, 1918, Major Hartney was promoted to Group Commander of the First Pursuit Group and in December, 1918, was transferred to duty at Great Headquarters at Chaumont. In February 1919, he was promoted to the rank of lieutenant-colonel, returned to the United States and became successively Chief of Training, Acting Chief of Operations, and Chief of the Civil Affairs Division in the Office of the Chief of Air Service. Colonel Hartney resigned from the United States Army in October, 1921. In addition to the above decorations, he holds the Distinguished Service Cross, Legion of Honor, and the Croix de Guerre with two palms.

Official: National Aeronautic Association.
By: C. A. Tinker,
Director of Information.

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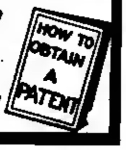

(*Concluded from page 62*)

or steel. Its disadvantages are that it is the most expensive material, that it will not stand rough usage, and that it will corrode in a salt atmosphere.

Brass has the advantage of not being subject to corrosion in either air or water, but it is the hardest material to work.

Steel is the least expensive material. It is also easier to work and is lighter in weight than brass. Its only disadvantage is its tendency to rust.

Duralumin has the same disadvantages for water piping as have already been mentioned.

Steel is recommended for water piping since this piping is of relatively large size in short lengths, and very little working is required.

Valves and Fittings. Ordinarily only one valve, the drain cock, is used in a water system. A commercial brass cock may be used since the difference in weight due to the use of brass is in this instance practically negligible.

The objection to the use of rubber connections in the form of rubber hose in gasoline lines does not apply in the case of water lines. The greater ease of making connections, the flexibility of the connection, and the saving in weight lead to the recommendation that it be used as standard practice.

A typical water system is shown in Figure 4.

Reserve Cooling System

Piping. The use of aluminum piping is recommended. Ordinarily relatively small piping will be used in the reserve water system which will give aluminum piping the weight advantage. The leads will seldom be short and direct so that not only will the weight advantage of aluminum be magnified, but the greater ease of working will be an additional advantage.

Valves and Fittings and Tanks. Saving in weight causes the recommendation of a combination of aluminum and brass for the valves and fittings, and the use of sheet aluminum for the tank.

Summary

The recommendations of the materials made in this article may be summarized as follows:

SYSTEM	PIPING	VALVES & FITTINGS	TANKS
Fuel	Aluminum	Aluminum and brass comb'd	Aluminum
Oil	Copper	Aluminum and brass comb'd	Aluminum
Water	Steel	Rubber hose connections and Brass drein cock	....
Reserve water	Aluminum	Aluminum and brass comb'd	Aluminum

(*Concluded from page 67*)

safety at the altitudes shown in the table. On the other hand, even with exceptional piloting, these altitudes can not be appreciably decreased if a complete 180 degree turn must be made.

There is only one part of the maneuver in which a gain can be made, namely, the take-off itself. The pilot should so "play his field" on the take-off that a complete half turn will not be necessary.

The figures were computed and verified. The minimum altitude lost in the turn, and the best combination of air speed, angle of bank, and radius of turn to give the minimum were computed from the airplane coefficients. Then the altitude lost was measured in actual flight. The table gives only the altitudes which were checked in flight. The agreement between computed and measured values was so close that estimates can be made for other types by means of a chart prepared by the Air Service. There was, however, a discrepancy in the case of the Thomas-Morse, the computed value being almost 19 per cent lower than the measured value.

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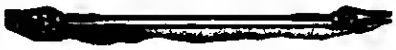

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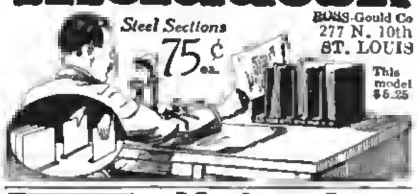

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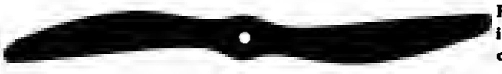

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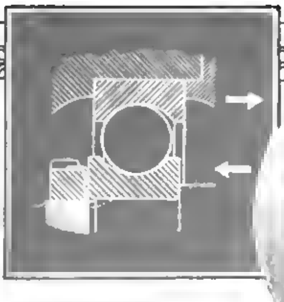

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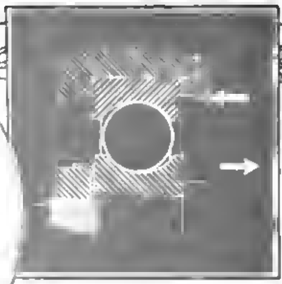

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Aerial view of the Yosemite, where trains and other methods of surface transportation go hundreds of miles around such portions of the natural terrain, while aircraft passes right over it without any hesitancy, making for "bee-line" routes whatever the contour of the earth's surface

Commercial Possibilities of Aviation

By Charles A. Moffett, Vice President and Governor Fourth District, National Aeronautic Association: President of the Gulf States Steel Company

THE commercial possibilities of aviation are illimitable. Passenger and goods carrying by aircraft has potentialities of so wide, so vast development that one might be ranked first among prophets to state even an approximate point where growth would slow up. Here, then, we have a proposition that possesses an elasticity unknown to any existing commercial transport facility. A catalogue of the commercial, industrial and financial interests of the country contains the names of those businesses which can and will benefit as aviation and business come to and take the steps to the fullest cooperation.

From the earliest days of our growth as a nation our chief concern has been transport,—the shortening of routes and gaining of time for goods delivery and individual communication. The United States has by its territorial growth been pushed ever onward in trying to keep up with its transport problems. It has been a fast pace with no breathing spells. Yet, when continental territorial expansion came to an end, transport was still in its infancy. The problems were growing more complex. But we attacked them with vision and broad-gauge principles, and now we know that by our industry, and enterprise, and foresight in unceasingly establishing lines on land and water we have won for our country the business leadership of the world and made this the richest nation ever known.

Without the marvelous development of transportation and communication this result would have simply remained in the realms of the impossible. We would still be in a state comparable with that of our Indian wards, and quite as content as are these wards with the humdrum of the reservation. We are hearing a great deal today about world isolation; in fact the term has become a figure of speech. Well, one can easily imagine that, without concern in transportation, we would have been a sorry figure of speech and of actuality today as a nation. It has made us great and powerful and a world factor that no influence can isolate us; that is, in the commercial sense of the word.

In land and water transportation, however, we are approaching the slowing up point. Here again, the foresight of business saw a new problem arising, and prepared to meet it. The outcome is the vast warehousing systems of the land, reservoirs which would absorb the goods items of transport and prevent the slowing up of our lines and the clogging of their arteries. So much for goods; but warehousing of the individual is impossible, for it is restrictive of liberty of action. It can't be done. And that brings us to the individual possibilities in commercial aviation,—the human factor in which the element of time is most important.

It is not difficult to eliminate this factor. Let us take a few well-known lines as examples. New York to Washington at best is five hours'

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travel by rail. By air it is being made every day with clock-work reliability in less than two hours and thirty minutes. New York and Chicago are twenty-two hours apart by rail; by air line the distance is negotiated in ten hours. San Francisco is at best four days' distance from the Metropolis by rail flier; by air flier it can be done in twenty-eight hours when a single gap of 900 miles is flown at night. It is now done by Air Mail, covering this gap by express train in 34 hours.

It is ever a race to beat time. We have reached top speed on the surface in the instruments of transport. Only the unrestricted air remains for venturing beyond that surface limit. We have ventured and today there is to America's credit the endurance, speed, and altitude supremacy of the world. This fact shows that the instrument is here for adaptation in the commercial interests,—and as America has demonstrated its superiority in speed and endurance and altitude by test, it remains only to utilize it to the satisfaction, and the profit, of the individual now held in leash by the slower means of transportation. It is being so utilized more and more, and when a goods-carrying service such as the Air Mail, places before us a record of close to 100 per cent operating performance for an entire year,—the question of adaptability is backed by the preponderant weight of reliability. So transportation by air is no longer experimental. It is proved by proof.

Time saving, perfection of performance, reliability and safety, of themselves, however, are elemental. Having these, the next great step is the establishment of stations and terminals; in other words, properly built and fully equipped landing fields. We have made rather wonderful strides in a few years in the establishment of fields in every state in the country; but the development has been more along trunk lines. It is one of the important functions of the National Aeronautic Association to foster, encourage and advance the establishment of flying fields, and it is putting a willing and aggressive shoulder to this wheel and hastening the installation of feeder aerial lines, with the object in view of making it possible for the most isolated hamlet to utilize travel and transport by aircraft. It is a great work and is being done with a spirit and completeness that deserves the most whole-hearted commendation.

All the while, too, the satisfactory air transport performance of today, is the spur to perfection of the morrow. It moves forward as inexorably as time. Thirty-five hours of engine propulsion of an airplane yesterday influences the reasonable attempt at a forty-four hour endurance flight tomorrow. We are going onward in the air, just as we went onward on the surface, but at a much faster pace. Twenty years ago man first went aloft in a power-equipped airplane; two years ago he sailed from England to Australia; three years ago he hopped across the Atlantic in less than twenty-four hours. This year he will encircle the world, or at least develop the reasons why circumnavigation will be a fact next year. One could go on indefinitely in laying before the court of public opinion the evidence of illimitable commercial possibilities in aircraft transportation and communication. But I will rest my case, confident of a favorable verdict.

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Craigia Bridge, across the Charles River, and downtown Boston, the State Housa and the Custom House bsing ths leading landmarks. Cities in the future must furnish terminal facilities for aircraft, as well as for steamboat and railroad, otherwisa they wili not garner in the hsnefits of the most rapid transportation systam, aviation

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Some Phases of the Army Air Service

By

Major-General Mason M. Patrick

IN REVIEWING the progress and the present condition of aeronautics in general and of the Army Air Service in particular, it seems possible that our citizens may have been lulled into a false sense of security through the favorable publicity given to our aeronautical accomplishments during the past calendar year. Success cannot be permanently attained unless the foundation upon which we build is solid and enduring. This is as applicable to the creation of an Air Service adequate for the protection of our country in an emergency as it is to any other human undertaking. It is true that during the past year an Army airplane piloted by an Army officer reached the highest altitude yet attained; that two Army pilots in an Army airplane made the longest sustained flight ever made in an airplane; that the same officers and the same airplane covered the greatest distance between two points that has ever been covered by an airplane in a non-stop flight; that other Army Air Service officers in Army airplanes broke all existing records for speed around an enclosed course and over a straightaway. The efforts which resulted in these achievements were not undertaken for the mere purpose of breaking records, but were made in the natural course of improving the aircraft in which we have to fly. Technically, however, we may claim to be at least abreast of any other country.

These gratifying performances do not constitute the whole of our accomplishments in the improvement of the types of aircraft with which the service must be equipped. A desirable bombing airplane must be capable of carrying a great weight. We are now assembling an airplane with a wing spread of 126 feet, powered with six Liberty motors of 400 h. p. each, and capable of lifting 20,000 lbs. This airplane can easily carry a five ton bomb in addition to its crew and fuel. A helicopter which seems to possess a high degree of stability has been designed and flown successfully by the Air Service. While this is but a first attempt, and many modifications are necessary, its development appears to hold much of promise for the future. Much, too, has been accomplished in the development of lighter-than-air craft which it is purposed to inflate with helium gas and use for long distance reconnaissance, for the transport of material and personnel and probably for carrying airplanes. Experiments have proceeded far enough to show that it is feasible to attach an airplane to an airship and to detach it at will while both are in flight.

Congress has not been ungenerous in its appropriations to the Army Air Service for the purpose of experimentation with and development of aircraft, and it is believed that the results enumerated above and the accomplishments of preceding years are sufficient to justify the satisfaction our citizens have found in the favorable publicity given to Air Service achievements.

But there is another side to this picture. The greater the development in aircraft, the greater the need for trained personnel to man them. Indeed, when we are dealing with airplanes that rise to heights of more than six miles, and fly and maneuver at speeds in excess of 200 miles an hour, it is understandable that we must train men to endure the physical strains to which they are subjected. Our experience in the late war indicates that personnel to man the aircraft then in use required a period of approximately nine months' training. It is not believed that this period of training can be shortened for personnel to operate aircraft which will be used in the next war. And yet hand in hand with the development of material has come reduction of Air Service personnel.

The present authorized strength of the Army Air Service is only 8764 enlisted men and 1061 officers. After assigning small Air Service components entirely inadequate for their proper defense to the Philippines, Hawaii, and Panama, and to the training centers for peace time training in this country, there remains only sufficient personnel to maintain in the United States at greatly reduced strength, one Pursuit, one Attack and one Bombardment Group, and the Observation Squad-

Major-General Mason M. Patrick

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rons in each Corps Area. How greatly the strength of these organizations is reduced below their needs is evidenced by the plight of the Pursuit Group. Approved Tables of Organizations for a Pursuit Group call for 101 officers and 735 men. It has been possible to assign only 15 officers and 600 men to our single Pursuit Group, the only aggregation of fighting planes in the United States for our defense from an air attack.

If a war broke tomorrow, it would be possible to bring this Pursuit Group to an effective strength only by robbing our training centers of personnel whose loss would render it practically impossible to train replacements. War losses will be large, no doubt our Pursuit Group will be depleted rapidly, there will be no properly trained pilots to replace those who fall.

The mission of the Air Service in the next war will, it is believed, be divided into two major parts. On the one hand, it will act as an auxiliary, furnishing ground troops with information obtained by reconnaissance and surveillance and by photographs, and by assisting our Artillery in the adjustment and regulation of its fire. In addition, what may more properly be called the air force may be given missions of its own. This component will consist of Pursuit, Bombardment, and Attack aviation. Such a force should be in readiness to attack the day when war is declared. The use of airplane carriers will permit an enemy to bring air force units to within striking distance of our shores. Proper preparedness demands that we be in a position to oppose such an attack with Pursuit aviation adequate for the destruction of the enemy air force. This would permit our Bombardment aviation to attack and sink enemy airplane carriers and such part of his fleet as may have accompanied them. Our lack of preparedness is evidenced by the condition previously cited of our one and only Pursuit Group.

The condition of our regular Army Air Service would not be so serious if we could count upon the aid of a properly equipped and adequately trained National Guard and Organized Reserve, but a limitation upon the number of National Guard Units that may be organized and the reduction of appropriations for the training of Organized Reserves has accompanied the reductions which the Regular Army has suffered.

So then, while we are justly proud of the technical accomplishments of our personnel assisted by what remains of the aircraft industry, we should face the fact that our lack of an adequate and properly trained Air Force may place our country at the mercy of any enemy power possessing a real Air Force ready to be launched against us at the very outbreak of hostilities.

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Bunker Hill Monument, Charlestown, Massachusetts. It is interesting to speculate on the conduct of the fighting at Bunker Hill, and the results following, had the Colonists been possessed of one good airplane

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Reproduction of a painting of the new aircraft carriers to be built by remodelling the two battle cruisers, Lexington and Saratoga. These will be the most completely equipped of any ships of their kind in the world

Fleet Aviation

By Edwin Denby, Secretary of the Navy

PERHAPS one of the most significant orders ever issued by a fleet commander is that of Admiral Hilary C. Jones, Commander-in-Chief of the United States Fleet covering aviation classes on board ship. The order reads as follows:—

"The Commander-in-Chief desires that on all vessels of the Fleet to which aircraft or aviation appliances have been assigned, classes, whenever practicable, be conducted in aviation subjects for the benefit of ships, officers.

"Instruction should first cover the general principles governing flight and the fundamental laws of aerodynamics, progressing to descriptions of the various types of aircraft used in the naval service, their potentialties and limitations. When considered desirable by commanding officers, officers desiring to do so may be permitted to make actual flights with qualified naval aviators.

"The purpose of classes as described above is to generally familiarize all officers in the service with the possibilities and limitations of aircraft at present in use, and qualify many to render constructive criticism relating to the application of aviation agencies towards the solution of naval problems."

This order, of course, means, that fleet aviation is certain to have a very important effect in a future naval campaign.

A fleet whose aviation is inferior to that of the enemy will operate under a grave disadvantage, which might well have a decisive influence on the result of the war.

During the World War, the efforts of our Navy were directed toward the building up of coastal aviation. This was due to the peculiar situation when the United States entered the War, that is to say, the German submarine activities were so wide-spread through the British Channel, the Bay of Biscay and the Mediterranean that

Secretary of the Navy Edwin Denby

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Courtesy of the Royal Italian Navy

By aerial photography the exact position of guns, ships, docks and defenses of all kinds may be accurately plotted. Here is a photograph of the Austrian ships in the Pola Naval Base on the Dalmatian coast, taken in June 1918, by the Italian Naval Aviation forces in conjunction with the American Naval Aviation forces from Porto Corsini

it was necessary to build up huge coastal stations equipped with aircraft to combat these submarines, an undertaking which was carried out with pronounced success. Further, during the War, because of the fact that the British Fleet had sufficient aviation units, we were not obliged to contribute to that phase of aeronautical warfare.

Since the War, however, we have spent our major effort in placing aviation with the fleet. There has been built up in connection with the United States Fleet several factors which contribute to the developments of aeronautics as a special adjunct to the fleet, comparable to that of submarines, destroyers, and other special craft. What those measures are, form an interesting chapter in the history of the United States Navy.

Immediately following the War, eight battleships were provided with platforms fitted over their turrets from which specially designed planes could fly off. These proved unsatisfactory because they interfered with the operation of the turrets and because the only planes which could fly off the platforms had very inferior characteristics while in the air. Latterly, we have developed a form of catapult placed on the deck of battleships which can be turned in any direction, in the same way that a turret may be moved, and planes projected without interfering with gun-fire or any other routine activity of the ship. This is one of the most important developments of naval aviation in any navy in the world. Our catapults are designed for projecting into the air any type of plane which fits into the tactical and strategical use of aircraft with the fleet.

One of the first duties which will be required of fleet aviation in future wars, will be to carry our reconnaissance over enemy bases. While our fleet is still at a great distance from the enemy, his fleet will probably be assembled at one or more of his naval bases. The Commander-in-Chief must know the distribution of the enemies' forces to conduct the situation. In the Army, airplanes are selected for solving such problems, what could be more natural than for the Navy to use the same instruments?

If the enemy bases were within one or two hundred miles of our coast, our scouting planes could carry out reconnaissance from our land bases. In the World War, our little seaplanes based on Porto Corsini could easily fly across the Adriatic, a distance of sixty miles, and take photographs of the Austrian fleet at Pola. However, these conditions will probably not be repeated in a future war. If we are to reconnoiter enemy naval bases, it must be done by airplanes flown off aircraft carriers. For the carrier to be able to operate close in to an enemy base, it must have high speed to permit it to keep ahead of an enemy battleship or battle cruiser and to dodge torpedoes fired from enemy destroyers and submarines. It must have a large battery of rapid fire guns to keep destroyers and light cruisers at long range. It must have a numerous anti-aircraft battery for keeping bombing planes up to a maximum height.

At the present time our Navy has but one aircraft carrier, the Langley, which is an experimental carrier, being the remodeled collier Jupiter. As a measure of economy in experimenting with carriers to determine the characteristics necessary to permit them to engage in operations such as detailed in the foregoing paragraphs, the Jupiter was selected as the naval vessel which could most readily be built over and which would without great structural changes give maximum deck space

Official U. S. Navy

The battleship Oklahoma puts to sea with a fighting plane on her forward turret. This method of carrying aircraft has given way to the catapult mounted on deck

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and storage facilities. Then, too, it was necessary to develop aircraft suitable for taking off and landing on a floating platform, such as a carrier really is. In order to do this economically, the experimental carrier was a necessity.

By knowledge gained from the comparatively inexpensive Langley, we have been able to design an efficient type of carrier, by remodeling two of the giant battle cruisers under construction, which were at first intended to be scrapped under the terms of the treaties resulting from the Washington Conference for the limitation of naval armament. Under these treaties, we were allowed to convert the battle cruisers, Saratoga, building at the New York Shipbuilding Corporation's shipyards at Camden, N. J., and the Lexington, building at the Fore River Shipyards of the Bethlehem Steel Corporation, at Quincy, Mass.

These two ships will be in reality, floating airdromes with enormous decks for taking off and landing, with machine shop facilities for the repair and upkeep of aircraft and storage facilities for them below decks. In other words, these two carriers when placed in commission will be combination hangars, machine shops, and landing fields. They will he 850 feet in length, with a beam of 105 feet, and able to maintain a speed of 33 knots. They will be fitted with powerful turbine generators which will make them unparalleled in the field of marine engineering, for they will have greater horsepower per shaft than has ever been projected in any marine installation, no matter what the type of ship or type of motive power.

Thier speed of 33 knots, which is developed by electrical propulsion, is equivalent to 39 miles an hour on land, the speed of the average express train, and this notwithstanding the fact that the ships weigh 33,000 tons each. The peculiarities of these ships, which make them the foremost of their type ever laid down, are the completeness of radio installation for sending and receiving messages; the elevators for lifting aircraft to and from the decks and the storage space below; the cranes for hoisting outboard and inboard heavy reconnaissance planes; the methods of ventilation and removal of exhaust gases from the smoke stacks, and the maneuverability of such huge ships in a seaway.

Official U. S. Navy
The experimental aircraft carrier Langley successfully points the way for providing the fleet with aviation. She is a floating flying-field, hangar and airdrome

Here indeed, is the acme of naval construction and the one great source for supplying the fleet with aviation units for search and reconnaissance scouting, protective scouting, bombing, torpedo attack, gun-fire spotting, and pursuit and protective fighting.

In order that every officer in the Navy may be conversant with the uses of aircraft with the fleet, so that the added air force strength made available by these carriers may find its ultimate use as an adjunct to the fleet, Admiral Jones' order is at once seen to be of the utmost moment to be efficiency of our naval personnel. When our great carriers are ready to take their place with the other navol units, our officer personnel will be ready to accept the responsibilities thereby entailed.

Official photograph, Aircraft Squadron, Battle Fleet.
Martin Observation Monoplane now being tested out by Aircraft Squadron, Naval Air Station, San Diego, Cal.

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Speeding the Mails

By Postmaster General Hubert Work

THE advantage of aerial over surface transportation in expediting the mails has been demonstrated beyond all peradventure of a doubt.

With seventy planes now operating in the Air Mail Service by relays across the country between New York and San Francisco, delivery of millions of letters is being hastened that would otherwise be subject to the delays of railroad traffic.

Not only has the performance of aircraft in carrying the mails proven efficient, but it has reached the stage of almost absolute reliability. The missing of a connection at a railway terminal or the failure of a pouch of mail to catch a trans-continental train no longer means that this mail shall be held up for from twelve to fifteen hours awaiting the departure of the next train. Its immediate dispatch over an air mail route assures it such rapid transportation as to overtake a limited train running on a fast schedule at the next stop where it is picked up to continue its journey by rail.

The attainment of the air mail service in 1922 scored 95.52 per cent out of a possible 100. Traveling through rain, fog and snow over high mountain peaks and deep valleys and encountering every variety of air currents, its planes maintained an accurate flying time during 7,999 trips for a distance of 1,756,803 miles. Of these trips, 2,835 were flown in the rain, while the total number of letters transported reached 60,487,880.

But this record approaching perfection was achieved by the daylight operation only and further development of the speeding of the mails by airplane must naturally cease unless the night time is to be utilized. The Post Office Department realizing this situation has already departed from its conservative policy. Preparations for an experimental night-flying service from coast to coast are being made which will undoubtedly be the first regular night aerial system of transportation in the history of the world. It is planned to fly at night a distance of 900 miles between Chicago and Cheyenne, Wyoming, after which the rest of the journey to San Francisco will be conducted in the day time. The schedule is based entirely upon a past performance of pilots of the service, so that letters mailed in New York before 10 o'clock in the morning will be actually delivered in San Francisco before the close of the following business day. This means the transportation of mail from New York to San Francisco in less than thirty hours. As mail carried by the fastest limited transcontinental trains now consumes four days enroute and is not delivered until the fifth day, the advantage of such aerial service over surface transportation is startling in the amount of time saved.

Postmaster General Hubert Work

The money saving side of such expediting of first-class mail will facilitate financial transactions between New York, Chicago and San Francisco and this service will unquestionably prove the means for a wonderful acceleration of financial, industrial and commercial activities.

It is cheering to note the recognition and encouragement of this purpose to operate this night line. We are receiving it from all sections of the country in editorial expressions voicing the best wishes of the people for this new venture and a confidence that the Air Mail record in the future will continue as splendid as that of the past. We cannot possibly ask for more than that, and I have been assured by business men and experts in aeronautics that the experience of the last four years affords them no reason for expecting less.

This is very gratifying, to be sure, but it does not emphasize the actuality, which is, that unless we can make flights at night the Air Mail Service will not have established its substantial value. If night flying can be established, then the service will have definite commercial value; and when that develops it is our present thought that the Post Office Department should let the carrying of the mail by contract by airplanes precisely as it contracts for its transportation by rail now. It is not the intention of the Department to indefinitely continue as an operating agency in the matter of Air Mail. We are, therefore, wholly interested in developing night flying to determine its commercial advantages. And if it proves of commercial use, the carrying of the air mail by private contract can then be effected.

It has been demonstrated that the mail by day airplane, can be carried safely, so that it is not necessary to pursue that experiment further. The question now to be determined is whether the same record can be made

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Dr. Hubert Work, Postmaster General (at left) receiving from Dr. George W. Lewis, Executive Officer of the National Advisory Committee for Aeronautics, and Chairman of the Collier Trophy Committee of the National Aeronautic Association of U. S. A. (at right), the Robert J. Collier Trophy, awarded to the personnel of the Air Mail Service for the greatest achievement demonstrated in the use of Aviation in 1922. Just back of Dr. Lewis is standing Carl F. Egge, General Superintendent of the Air Mail Service

approximately over the 24-hour period, and our Air Mail Service has been working on that proposition for some four months. This work logically devolves upon the Government, for it is not difficult to realize that if the Post Office Department neglected this new field, its development would be retarded for years because the venture would afford little promise to investors. The important fact that appeals to the most liberal of investors relative to any new enterprise is that of full operation. And as full operation of the Air Mail is still in the future, it is patent that adequate financial backing for a private commercial carrying enterprise would be very timid, if not absolutely apathetic.

The Post Office Department has already established some lighthouse stations to light the field; also pilot lights along the way to define the routes. Emergency fields for landing have also been located. Still to be developed is an instrument that will advise the flier how close he is to the ground at night, and some apparatus must be devised that will assure pilots of their position and safety at all times during the night voyage. These necessary devices are now being worked out and to a large extent the responsibility for it lies with the Second Assistant Postmaster General Paul Henderson, in charge of the Air Mail Service, and Carl F. Egge, General Superintendent of the Air Mail Service. Through their efforts present indications are that these mechanical improvements will be ready when actual service schedules are inaugurated.

In this work the postal service has no competition in the air, but is competing with trains averaging 45 miles an hour. It is already a fact that the airplane has advantages over the train. With night flying the element of competition in expediting the first-class mail matter will be successfully overcome.

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Air Mail Station at Reno, Nevada

The Practical Importance of the Free Flight Work of the National Advisory Committee for Aeronautics

By Thomas Carroll, Chief Test Pilot, National Advisory Committee for Aeronautics

AT THE laboratory of the National Advisory Committee for Aeronautics at Langley Field, research is being carried on in all of the branches of aeronautics—airplane design and performance, and engine development and improvement. The plant of the laboratory now covers a large plot of ground and occupies seven buildings including a most up-to-date hangar and airplane shop, operating a dozen airplanes of various types. The personnel amounts to about sixty persons.

This work, being done as it is on an Army Post of large dimensions, almost becomes lost among the many and varied activities of the Air Service at Langley Field. But the influence of the work is rapidly being appreciated throughout the world. This statement is meant in its most literal sense, "throughout the world." It has been the pleasure "The thrill that comes once in a lifetime," for many at the Laboratory to see laudatory comment in foreign journals of many tongues and in the aeronautical press of our own country, accompanied more often than not, with excerpts from the reports and notes for which they have been responsible together with the modestly anonymous photographs of apparatus and personnel.

Withal, it is felt that much of the information in the National Advisory Committee for Aeronautics Reports is not hitting the mark in the minds of the big half of the people interested or engaged in aviation, particularly among the all-important class, the pilots.

As a pilot, the writer believes that pilots, as a group, are under educated in the fundamentals of aviation, due perhaps primarily to the puerile, "theory of flight" courses of the war time ground school days. Better this might have been omitted, than that its insufficiency and incompleteness should have shaped its student pilots' minds to channels in which they have become mentally mired. So it is, perhaps, not the fault of the laboratory data per se, nor of the pilots themselves, that the work being done *for pilots* is not of sufficient interest to, or appreciated by them.

While it is evident that all of the work of the laboratory at Langley Field is of importance and interest, it is nevertheless true, that there are certain phases that appeal more strongly to pilots, or other flying folks, who can not assimilate pure theoretical research data.

For instance, while the work of the wind tunnels is necessary to the study of design, in order that improvement may be made economically and expeditiously, still the limitations of the wind tunnels are so generally misunderstood that the solution of their problems has not the appeal that their intrinsic work should accord them.

Likewise with the developments in the engine section, particularly the positive drive, supercharging, and fuel injection problems. These are important and the perfection of either would cause comment universally, not alone in the aero world, but in the whole newspaper reading world. The supercharger will improve the performance of the gasoline engine at higher altitudes where advantage may be taken of high velocity winds, for long cross-country flights, and will give supremacy to our fighting aircraft, should the United States be so unfortunate as to engage in another war of major dimensions. The other is intended to give us an improved internal combustion engine without those parts most prone to failure, electric ignition and automatic carburetion, and in addition will allow the utilization of a fuel oil of low flash point, which will lessen the now much too hazardous fire risk. But in their adolescence, these problems are not interesting to the man-in-the-street; it is in their ultimate consummation that they will receive the appreciation due them.

However, the flight work of the aero-dynamic section can not help but hold the interest of everyone who flies or hopes to.

Of these many experiments, the work in pressure distribution is quite rightfully the most interesting in methods, equipment, and results. Perhaps everyone is familiar with the theory of how the contour of the airfoil creates lift, but it has never been exactly known by anyone, just how this lift was distributed. Conjecture and computation had arrived at a generally accepted theoretical distribution, but it remained for the results of this investigation to show directly and conclusively this distribution with exactitude. Hence this data is not alone interesting to those who have wondered at the phenomena of L/D, but of immense value to the constructor of wings, that his loading and its distribution may be a predetermined factor. And in addition to the usual research work in this direction, it was carried further along to speeds of 160 miles per hour, in order that the data would be up with performance progress and not be obsolescent when it is given to the world.

No review of the work of the laboratory, is complete, without mention of the various recording instruments. These instruments, marvelous in their inception, are now, after a long period of use, constant redesign, and refinement, almost human, and much better than human in the infallible certainty of their observation records.

Chief Test Pilot Carroll in Spad VII

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These mechanical observers have been often described in detail in this journal and in others of the technical press, nevertheless, they will bear a short description of their purposes here.

The data which an observer of flight performance gathers during a test flight, comprise the air speed, the rate of climb, the angle of flight path, the rate per mile of the engine, and such matters as can be observed from the navigation instruments. These figures are jotted down hurriedly on his data sheet, stop watch in hand, for the time intervals and the whole is written up on the ground in the office.

The things of interest which are only manifest through the senses of, and impressions upon the pilot can be obtained in but one way,—so far.

So the observer fills out his report from conversation with the pilot over the cigarettes. "How much rudder does she carry?—Do you have to hold her nose up much in the climb?—Is she heavy on the ailerons?" and the flight chart reads, "The pilot reports reasonably good maneuverability—etc." or sometimes language better in conversation than in print appears "Pilot reports that controls are excessively stiff," or "Difficult to bring out of a dive" or the like.

So this is the part that the National Advisory Committee for Aeronautics recording observation instruments play so well in determining the accurate performance of an airplane—and more particularly in the case of single seaters where, under the old order the pilot tried manfully, and usually unsuccessfully, to write, or remember all the data mentioned above.

So we have our recording instruments—an air speed meter, very sensitive to the smallest variation in speed (the same instrument with but small modifications will show changes in altitude very accurately); a recording electric tachometer of extreme accuracy; an instrument called a kymograph which shows the angle of the flight path with the horizontal: a recorder of the exact position of all of the three controls simultaneously and continuously; and our newest, an instrument which indicates to a finger's pressure the force exerted by the pilot on the handle of the control stick or upon the rudder bar.

Add to all of these our accelerometer, showing the variation in loading on the airplane during maneuvers, and a gyroscopic instrument which gives you the rate of rotation about the various axes during any maneu-

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Assistant Test Pilot King in the SE 5

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The SE 5 fitted with instruments installed for performance tests

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The Fokker D VII, the pursuit type of the German Air Service in 1918

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A front view of the Spad VII showing the excellent streamline form

ver or stunt, and you get a sheet of data from a ten minutes' flight that no human observer could record in any number of flights.

It all sounds as though a Handley-Page would be required to carry it all, and a switch board like the control board of a power house to operate them. But that is not the case, they can all be installed in a single seater, a SPAD, S. E. 5, or Thomas-Morse, with less weight than the military load and to operate them we have a single switch or contact button that a pilot can throw on and off without removing his hands from the stick or throttle, if he likes. And neither do they require the slightest attention while flying; they all operate from a common battery and are synchronized automatically.

An investigation, very interesting to pilots, is in preparation at this time at Langley Field. It has to do with the relative abilities of the single seat fighters most commonly considered as the best of the period at the end of the War. They are the SPAD of the French and Americans, the S. E. 5 of the British, and the Fokker DVII of the late German Air Force.

They are representative of distinct types—although contemporary, and to a large extent cover all of the types that are known to this branch of military flying.

The radial or rotary engined airplanes are not considered in this work so far. Radial types are in the ascendancy just now, but it is interesting to note that one of the most potent reasons for the use of engines of this type has been apparently disproven by some of the experiments lately completed in the National Advisory Committee for Aeronautics. Carrying on in the wake of theoretical dogmaticism and in this case perhaps finding the idol with clay feet, it was sought to inquire whether the accepted rule that maneuverability was improved by the bunching of weights near the center of gravity, as in rotary or radial engined jobs, was founded on real fact. The re-

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The kymograph, an instrument which shows the angle of the flight path of the airplane to the horizontal

sults, while not conclusive or universal, owing to the fact that but two types of airplanes were investigated, nevertheless have demonstrated that the addition of considerable weights located far from the center of gravity, thus increasing the longitudinal and lateral moments inertia, had no appreciable effect on the maneuverability.

So that while the advantage of air-cooled engines is obvious, as is their desirability for fighting aircraft, the advisability of placing the cylinders radially in a single plane is obviated, at least so far as aerodynamic reasons are concerned.

In the three types mentioned, the SPAD, the S. E. 5, and the Fokker, to those familiar with them there is little that can be said in praise of the virtues of any of them. They are all good and for different reasons. The SPAD for her ease of control, good speed, diving ability and exceptionally steady gun platform. The S. E. 5 for her inherent stability, making her pleasant on long patrols, smooth maneuverability, good climb, and good vision. The DVII for its combination of all the above. But the SPAD is rather blind and doesn't permit liberties in fast maneuvering, the S. E. 5 is slow and inclined to be "flicky," that is unsteady, in a dive or in some part of a maneuver, spoiling the gunning. But the DVII is slow, too, although it dives well.

Could we combine the speed and rigidity in flight of the SPAD, the visibility and climb of the S. E. 5, the maneuverability of the S. E. 5 or the DVII, together with accessibility for maintenance and repair, we would have a real pursuit ship. Speed, which is to all intents a matter of horsepower, can be increased by the installation of the newer engines of high performance.

It is well enough to say—incorporate these virtues in a new type, but do we know the cause of these effects? With relatively the same engine power, the SPAD is far faster than either of the others, yet the S. E. 5 has less frontal resistance in her struts and R. A. F. wires and the DVII has no wires at all. So the difference must be in the streamlining of the fuselage and in the wing sections. And so it is with the qualities of the others.

Again, controllability and maneuverability, quantitavely, speaikng are never more than the conglomerate

(*Concluded on page* 119)

The French Spad Type VII, the British SE-5 and German Fokker D VI ready for tests for maneuverability and controllability. Pilots Carroll and King in the foreground

Aviation Work of the Bureau of Standards

By Fay C. Brown, Ph. D., Acting Director, Bureau of Standards

SINCE its establishment in 1901, the Bureau of Standards has grown to be one of the largest research and testing laboratories in the country, its work covering all fields of manufacturing industry and all branches of physical science. In addition to its primary function of maintaining the standards of weights and measures, it now maintains many other standards of importance to industry; it recommends standards of practice; it establishes standards of performance; and it solves many technical and scientific problems in its large laboratories employing nearly a thousand men and women.

In addition to aviation problems discussed in the succeeding paragraph, the general work of the Bureau is of value to aviation in many ways. In particular might be mentioned its work in connection with lubricating oils; its storage battery work; its studies of the properties of metals, cloths, and numerous other materials; and its work in photography.

The aviation work is for the most part, undertaken in co-operation with the Army and Navy Air Services, and the National Advisory Committee for Aeronautics. They finance the work and decide on the problems to be solved. They also furnish the practical flying experience, and in a general way, they do the engineering part of the work as distinguished from the scientific. The function of the Bureau of Standards in the solution of the technical problems involved, and the discovery of basic natural laws, and the measurement of data. It supplies the fundamentals on which later development is based.

Aircraft Structure

The ideal in the design of aircraft is to eliminate uncertainties as to the strength of parts, so that each part may be made strong enough for the load it is expected to carry without being made necessarily heavy. This is true of all engineering construction but it is especially true of aircraft, for here, too much weight does not merely increase the cost of construction, it increases the cost of operation as well. In fact, it often pays to go to a great deal of expense in building a machine designed to save weight and thus increase its efficiency.

Tension members can be calculated from the area of the part and the unit• strength of the material; but with others, this cannot be done. With struts, beams, wing ribs, and all other parts subject to compression or bending, the proportion and arrangement of the parts makes a relatively greater difference than the strength of the material. In such cases, it is usually necessary to build a full-sized piece and subject it to loads of the same nature as those it will be required to carry, and strong enough to break it. Such tests show how strong the part is, and, by studying the way in which it failed, means can sometimes be found for making it stronger without increasing the weight.

For making such tests, the Bureau of Standards is unusually well equipped. There are testing machines ranging from small ones used to test the lighter parts up to a large one of 1000 tons capacity which will test the largest aircraft parts. One of these is especially designed for the testing of aircraft parts, being built to accommodate very long specimens, yet having a relatively small crushing force. Special equipment has also been made at times when tests were needed that could not be performed on the regular machines.

Numerous tests have been conducted on various types of aircraft parts, such as wooden spars, beams, ribs, etc., samples of laminated and veneer construction, and metal girders. The greater part of this work has been done for the War Department, and the information so gained was used by the officers in awarding contracts for aircraft material.

Several years ago, a lot of duralumin girders for airship construction were tested, and it was found that these girders, as originally designed, had the longitudinal members too light in proportion to the diagonal bracing, and in the next lot, a re-distribution of the weight was recommended. This change in design resulted in a great increase in

Fay C. Brown, Ph. D., Acting Director Bureau of Standards © Harris Ewing

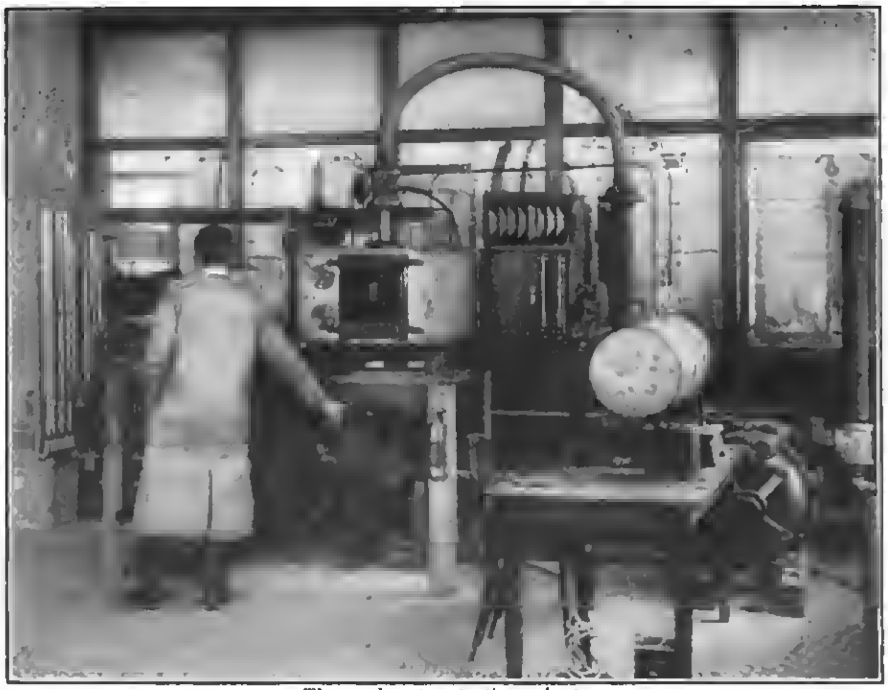
strength without any increase in weight.

Recently another set of girders intended for the airship ZR-I has been tested. The result has shown them to be very good girders, as good, in fact, as could reasonably be expected, and no change in design was necessary.

During the war a design for a metal wing was submitted to the Bureau for test. It was found considerably weaker than a spruce wing of the same weight, but members of the Bureau staff were able to suggest improvements in the design which ultimately resulted in a wing which had the same strength for its weight as a good spruce wing.

A variable camber wing, for increasing the difference between flying and landing speeds, was invented by a member of the staff and was tested in the laboratories. It was shown to be about as strong as the regular type, but has not yet been developed to the point where it is commercially practical.

Of equal importance with lightness and strength is the ability to move through the air with minimum resistance, and the ability of the wings of an airplane to give the maximum possible lift per square



The carburetor testing plant

foot of area. Tests of these properties are made in wind tunnels where an artificial wind of known velocity is produced and the resistance and lifting power of a part or of a model are measured in suitable balances.

The Bureau of Standards possesses three of those wind tunnels. There is a four and one-half foot one, giving a wind speed of 90 miles an hour, a high speed tunnel of the same size giving a speed of 180 miles an hour, and a ten foot tunnel giving a speed of 75 miles an hour.

The Bureau of Standards from the air

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In these tunnels, tests are now being made of various models for the proposed army semi-rigid airship. These tests will be used in determining the form of the airship, and the size, shape and location of the elevators, rudders, and the stabilizing surfaces.

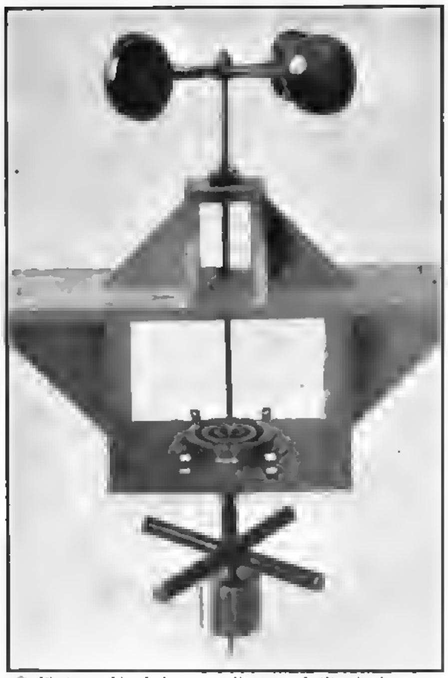
Aircraft Instruments

An important feature of the aircraft work of the Bureau of Standards is the testing and design of aircraft instruments for the Army and Navy. These include tachometers, air and ground speed indicators, altimeters, statoscopes, barographs, compasses, turn indicators, etc. Methods have been developed for testing instruments under conditions approximating those encountered in actual flying. The conditions of heat or cold, low pressure, air speed, and vibration, can be reproduced in the laboratory and their effect upon the performance of the instruments determined. A "dummy observer" has been developed and it is occasionally used for checking the laboratory tests with flight tests.

Several important aircraft instruments have been invented here. One of them is an altimeter of very much greater precision than the usual types. Most altimeters are built like aneroid barometers, with a cell enclosed by two thin metal diaphragms. The space between them is exhausted and sealed and a spring used is to keep them apart. It has been found in practice that the stiffness of these diaphragms causes a "hysteresis" or lag effect which may result in an error of several hundred feet. The new design gets rid of this difficulty by making the spring very stiff relative to the diaphragm. With a well-made spring the lag is greatly reduced, and the instrument is accurate to within ten feet.

An instrument of value to balloonists is a new kind of statoscope. This instrument tells the pilot whether he is rising or falling or on a level. Most instruments used for this purpose are not very reliable and sometimes permit the craft to go some distance and attain a fairly high velocity before they give warning. Then large amounts of ballast or gas may have to be lost in order to stop the motion. The new instrument is much more reliable.

Dr. R. P. Heyl, and Dr. J. L. Briggs, have developed a new type of compass which does away with many of the inherent defects of the ordinary magnetic type without involving the weight and complication



© Photographic Laboratory Bureau of Standards.
The Briggs-Hayl earth inductor compass

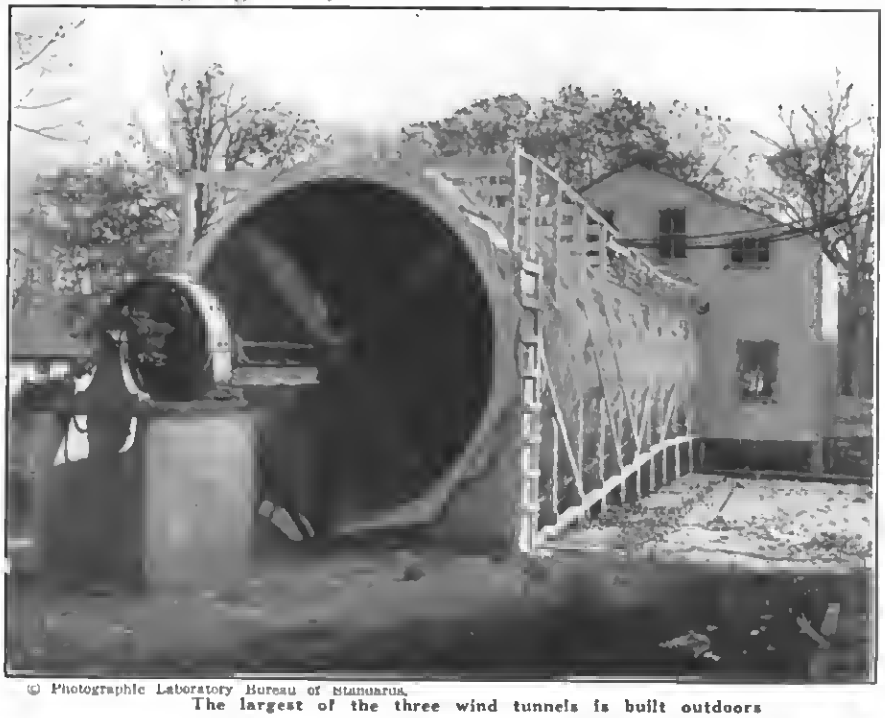
of the gyroscope compass. It is called the "earth inductor compass" and depends upon the fact that the voltage between brushes of a direct current dynamo depends, among other things, upon the angle between the axis of the brushes and the lines of force of the magnetic field. The earth's magnetism furnished the field and the brushes are mounted on the airplane and turn with it. The armature and commutator are driven by a wind wheel and rotate in a plane parallel to the surface of the earth. Two pairs of brushes are used, and they are set at right angles with each other. By means of a set of resistances, the voltages given by these two pairs may be balanced against each other to give a zero resultant. By means of a dial, the resistances are so adjusted that when the airplane is flying along a predetermined course the galvanometer reads zero, but when the machine turns out to right or left the galvanometer is deflected, the direction of its deflection showing which way the machine has turned out.

The dial and its resistances and the galvanometer are placed on the instrument board in front of the pilot. The revolving parts, which are the only parts affected by magnetism, are connected to the dial only by four wires, so they can be placed wherever convenient. In practice, they are placed in the tail of the plane where they are as far as possible from the disturbing magnetic effects of the engine.

A latitude indicator similar in principle to the compass is now being developed; this instrument depending on the inclination or dip of the lines of force.

Power Plants

The performance of an aircraft engine at high altitude is very different from its performance at sea level; and in order that its high altitude performance may be tested in the laboratory, two special altitude chambers have been built. They have reinforced concrete walls sixteen inches thick and are lined with cork insulation. A huge vacuum pump is provided with which the air in the chambers may be exhausted to the low pressure corresponding to the altitude desired. The volume of air



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The largest of the three wind tunnels is built outdoors

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exhausted is enormous, the pump being required to handle the entire volume of the engine exhaust. Air for the carburetor is let in through a throttle, and the inlet air and the air in the room can be cooled together or separately to a temperature of 30 degrees below zero. With the engine running, a temperature and pressure corresponding to an altitude of 33,000 feet can be maintained.

All the engine controls are placed outside. Thermocouples are used to measure the temperature of all parts desired and small windows of this glass permit the engine to be watched. The dynamometer which consists of a large dynamo, is placed outside. In these chambers various performance tests have been carried out. Each test includes a series of runs at full power and various speeds, runs with wide open throttles at altitudes up to 25,000 feet, runs corresponding to various propeller loads and altitudes, and runs to measure the friction horsepower, or horsepower required to turn the engine.

In this way tests have been made of various types of engines including Liberty engines, Hispano-Suizas, Packards, and others. Tests of the Packard 1551 to be used in the airship ZR-I have just been completed.

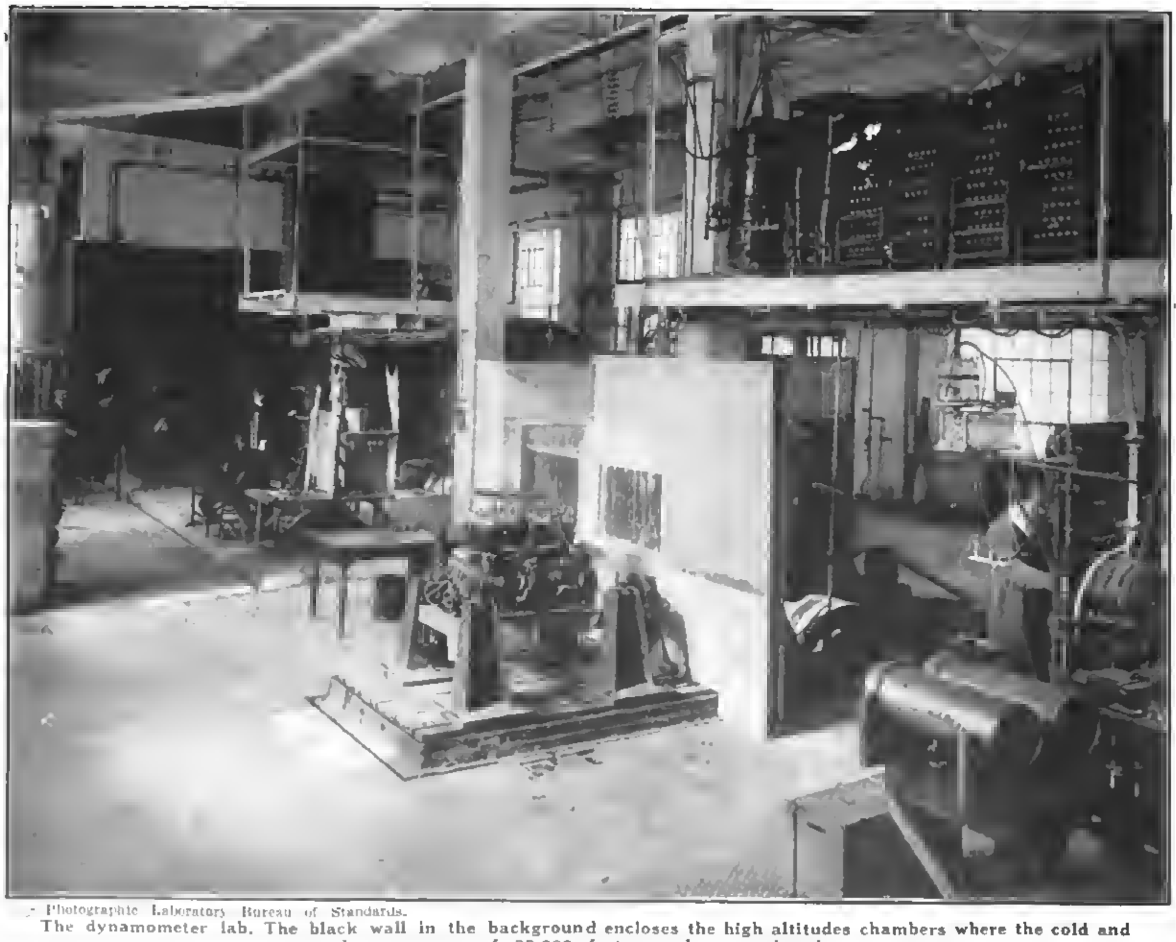
A special type of indicator has been developed for use with high speed engines. It gets rid of the inertia difficulties inherent in indicators of the usual type when used for such work, and it has the additional advantage that when used in the altitude chamber, all the parts that need to be made accessible can be placed outside.

There is a pressure element which screws into the cylinder like a spark plug and consists essentially of a light diaphragm, to one side of which the cylinder pressure is applied while a pressure variable at the will of the observer is applied to the other. As the value of the cylinder pressure passes that of the applied pressure, an electric circuit is opened or closed, making a click in a telephone. A rotating contact is also provided and the connections are such that when the applied pressure is made equal to the pressure existing in the cylinder, at the time this rotating contact closes, the telephone indicates the fact. The card is thus plotted point by point and the indicator requires that successive cycles be uniform for the period of the test.

No entirely satisfactory carburetor for aircraft has yet been devised, most of those now in use having a tendency to give too rich a mixture at high altitudes. Methods of testing carburetors under high altitude conditions have been developed and many carburetors have been so tested. So far, the hand adjusted ones are best in spite of this obvious disadvantage. Automatic altitude compensators similar in principle to aneroid barometers have been tried with satisfactory results. But these are liable to leakage which makes them unworkable when it occurs.

Mr. Sparrow has recently devised a method of control which looks promising, but so far it has not been tested. It depends on the fact that high pressure created by an air pump is proportional to the initial pressure, so that the difference between the two would vary with the initial pressure in an accurately calculable manner.

One of the big problems of the day in connection with aircraft engines is supercharging. This consists essentially in compressing the air from its initial pressure to a somewhere near sea level atmospheric pressure before it is taken into the engine. This prevents the loss of power that usually takes place at high altitudes because of the lessened



Photographic Laboratory Bureau of Standards.
The dynamometer lab. The black wall in the background encloses the high altitudes chambers where the cold and low pressure of 33,000 feet can be reproduced

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intake of air per stroke. So far the Bureau of Standards has done little work on this problem, but a series of tests is now being planned to determine the effect on engine performance of various possible methods of superchanging. The altitude chambers will be used in these tests, as it is possible to vary the inlet pressure and temperature, exhaust pressure, and outside pressure and temperature, in any manner desired. The conditions produced by any supercharger can be reproduced without actually building the supercharger; and the supercharger when built can he tested separately.

A one-cylinder Liberty engine is being used for tests on fuels and fuel blends. It is especially useful for studying the effect of different compression ratios, as the ratio can be changed by changing only one piston. Tests have recently been made with it, to study the effects on possible compression ratios of different blends of gasoline with alcohol or benzol. It was found that with benzol or alcohol as fuel a compression ratio of 14 could be used whereas the designed ratio was 5.4. This higher pressure was made possible by the absence of detonation to which gasoline is suhject. The tendency to detonate increases with the compression pressure and is decreased by adding benzol or alcohol. The use of a fuel that will not detonate makes possible a higher compression and greater efficiency without increasing the strength of the cylinder.

Radiators

Tests of the cooling efficiency and air resistance of various types of radiators have been made. The latter were made in the wind tunnels in the same manner. The tests of cooling efficiency were made in a special small wind tunnel in which air streams of any desired velocity and temperature could be produced. For the first tests a high altitude tunnel was used in which the air pressure could be reduced the same as in the altitude chambers. It was found however, that the cooling effect was independent of the pressure as such, except insofar as it may effect density, and this method was therefore abandoned in favor of the simpler method of using air at atmospheric pressure.

For a given radiator the cooling effect has been found to be proportional to the mass of air flowing through the radiator whether this mass represents a large volume of air at high altitude and low density, or a smaller volume of air at greater density. Experiments are now under way to determine the relations between this rate of mass flow of the air, and the actual speed of the airplane, the relation varying with the position of the radiator. Of the different types of radiators tests, it was found that, if the flow of air were unobstructed by other parts of the machine, the most efficient type of radiator would be that made of thin hollow flat plate. This type gives the least head resistance and the air flow through it is so much greater than through other types as to more than make up for the greater transmitting efficiency of some of these types. But so far the inherent mechanical difficulties of construction and repair have prevented its extensive use. If, however, the radiator is placed in the nose of the fuselage, as is often the case, a type more similar to the usual automobile radiator may be used to good advantage.

This work has given fundamental data on 125 different types of radiators with air speeds up to 65 miles an hour. It will be adequate for some time to supply the industry with fundamental data which must be correlated with flight performance and mechanical strength.

The Aeronautical Safety Code

Much trouble, inconvenience, and expense has resulted in the automobile industry, because of the shortsighted policy of the early manufacturers and users in combatting regulation of all kinds. To prevent a similar difficulty in regard to aircraft the Bureau of Standards in co-operation with the Society of Automotive Engineers has organized a committee to devise a safety code for the regulation of the industry. This committee contains experts representing the Army and Navy Air Services, the aircraft manufacturers, and all others interested in aircraft.

The aims of the code are as follows:—

1. To estahlish as technical standards the best modern practice in the design, construction, maintenance, and testing of the aircraft.

2. To standardize the shapes, sizes, markings, etc., of landing fields, and to make the American standard as uniform as possible with those of our neighbors.

3. To serve as a guide to the governmental regulation of the industry by establishing a code of traffic rules, rules for licensing pilots. etc., which will give adequate protection to the flying and non-flying public without unduly hampering the industry.

Some of the features of this code will serve as a guide in formulating the regulations of the Bureau of Civil Aeronautics, and the laws governing aircraft. Other features, especially those provisions dealing with the structure and engines of aircraft, will probably be enforced hy mutual agreement among the interests concerned.

The procedure of the American Engineering Standards Committee provides for the periodic revision of the code to keep its provisions in harmony with the progress of the industry.

(Continued from page 114)
opinion of test pilots, are being reduced through the media of recording instruments to definite units of measurement.

By these experiments it is not only confidently expected that a more accurate catalog will be made of the good points of these airplanes, but it is also expected that the "why" of many of these attrihutes can be definitely pointed out. and that by this chart, we may discover the answer to the question of how to make our pursuit ships better.

It is also proposed to incorporate all of these instruments into a single device which can be quickly and conveniently installed in any airplane for the purpose of obtaining a complete chart of performance data. Can a flyer afford not to take an interest in a combined instrument of this character? not alone from a consideration of the performance characteristics of the airplanes tested, but also to compare the charts of the same airplane flown by different pilots. Certainly the abilities of pilots will be as easy of comparison, through this agency, as are the data in regard to the inherent qualities of the airplane.

And so through the whole program of research experimentation, there are elements of popular interest. Each problem undertaken yields information not only for the aeronautical engineer, but also for the pilot, the observer, and for the man to whom aviation is but a hobby.

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What The Weather Bureau Is Doing For Aviation

By Willis Ray Gregg

Meteorologist in charge of Aerological Investigations

Willis Ray Gregg, Meteorologist, in charge af Investigations ot the U. S. Weather Bureau, is one of the world's leoding authorities on meteorology as applied to aeronautics. Essentially a Scientist, but possessed of an unusually proctical mind, Professor Gregg has contributed to the advancement of aeronoutics in a marked degree. His research investigations in the upper-air have been one of the factors in aeronautics in America and throughout the world.

Editor

CAPTAINS of ocean-going vessels, before starting out on a long voyage, invariably find out from the nearest Weather Bureau office what kind of weather they are likely to encounter, and, during the voyage are in constant touch, by means of radio, with sources of information as to what changes are in progress or are expected to occur. Shippers of perishable goods,—fruits, vegetables, meats, etc.,—seek the weather forecast and are guided thereby in providing against excessive heat in summer and severe cold in winter. So it is, to a greater or less extent and in increasing measure as means of communication improve, in all the basic industries. Aviation is now passing through what may be called a transition stage, more or less common to every great movement having for its goal the betterment of mankind and the advancement of civilization. It has successfully weathered the experimental stage, characterized by skepticism and discouragement. Presently it will emerge into the full-development stage, functioning efficiently and economically, an agency of great power in human progress. It is well, while we are approaching this latter stage, to examine the various factors that may and should contribute to its success, and it is universally recognized that, in the case of aviation, accurate and timely meteorological information is one of these factors, and a very important one. In fact, such information is *vital*, because, except in the take-off and landing, the air itself, in which all weather changes occur, is the sole medium for the navigation of aircraft.

This being the case, and it will of course always be the case, it seems not inappropriate to outline briefly what the Weather Bureau has done and is now doing for aviation, and to point out lines along which this service should be extended and developed to the end that the greatest possible efficiency may be realized. Such is the two-fold purpose of this article.

Past and Present

In 1870 a weather service was created by Congress as a part of the Signal Corps of the United States Army, and its network of stations soon embraced the entire country. On July 1, 1921, this service was transferred from the War Department to the Department of Agriculture, and its duties and functions were defined as follows:—

"The Chief of the Weather Bureau, under the direction of the Secretary of Agriculture shall have charge of forecasting the weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce and navigation; . . . . . . ; and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States or are essential for the proper execution of the foregoing duties."

This organic Act, under which the Weather Bureau has operated continuously since 1891, provides for meteorological service to meet all possible needs of agriculture, commerce, and navigation; and *aviation is of course, merely the navigatian of the air.*

In conformity with the organic Act, above quoted in part, the Weather Bureau has established and now maintains somewhat more than 200 regular meteorological stations, well distributed throughout the country. At these stations, in addition to continuous automatic records of the various elements, twice-daily eye-readings are made of pressure, temperature, humidity, precipitation, state of the weather and wind direction and speed. Similar observations are made at ahout 30 stations in Canada, and these are made available for use in this country. For forecasting purposes speed in collecting the observational material is a prime requisite and to meet this need the Weather Bureau, in the early days of its existence, devised a system which, with material extensions, is still in use, and which is not approached in efficiency by the meteorological service of any other Government. It would he interesting to describe this system in some detail, but lack of space will not permit more than a brief summary.

At 8 a. m. and 8 p. m., 75th meridian time, the times of the two daily observations. the Western Union Telegraph Company sets up individual wires called "circuits," connecting a majority of the principal observing stations in the United States, with two contact points in Canada—Toronto and Winnipeg. There are

Willis R. Gregg, U. S. Weather Bureau

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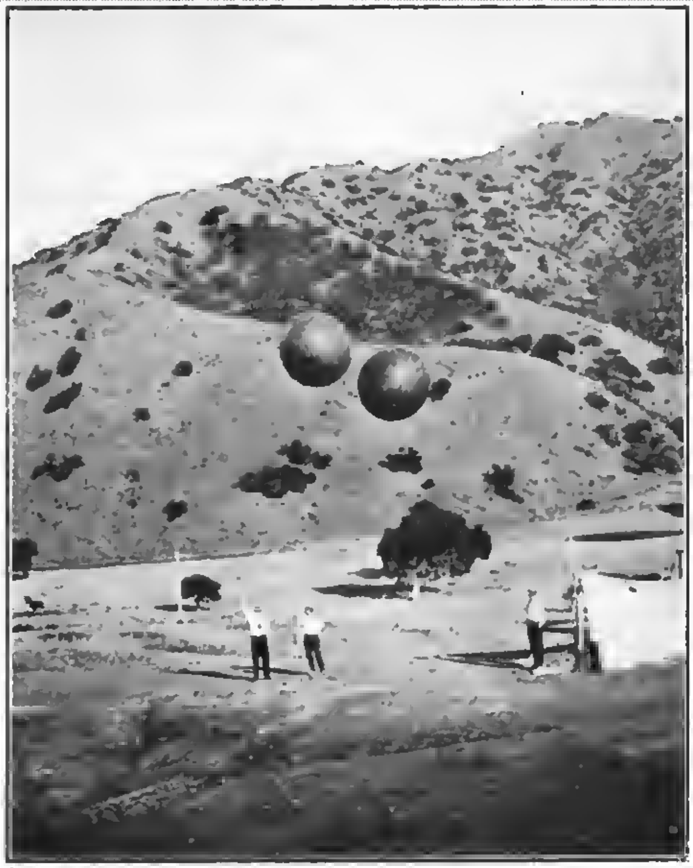
23 of these "circuits" averaging about 750 miles in length, the longest being 1340 miles and the shortest 231 miles. From 6 to 12 stations are on a circuit, with a telegraph operator at each point. Several circuits terminate at certain stations to facilitate the transfer of reports from one circuit to another. For example, one circuit extends from Washington to St. Louis connecting 11 stations, including Chicago, St. Louis, Springfield, Indianapolis, Terre Haute, Evansville, Cincinnati, Dayton, Columbus, Pittsburgh and Washington. Promptly at 8 o'clock the Washington observation is sent over the circuit and every operator along the line copies it. This is immediately followed in fixed order by the observations from other stations thereon. Simultaneously the same operation is being followed on other circuits. As soon as the reports of all stations on a circuit are sent, reports collected at the termini are transmitted to other circuits. By this arrangement of collection and transfer all reports are distributed to stations throughout the country by 9 o'clock and sometimes a few minutes earlier. In other words, in about an hour from the time of taking the observations they are received and charted ready for the forecasters.

In addition, numerous reports are received daily by cable and radio from Europe, the Azores, the West Indies, Central America, Mexico, Alaska, the Far East and from ships in the Atlantic and Pacific Oceans and in the Gulf of Mexico. These reports, together with those in the United States and Canada, have vastly extended our meteorological horizon, making possible more or less general predictions of the larger changes in weather as well as the specialized day-to-day forecasts which occupy a conspicuous place in practically every newspaper in the country.

For many years observations of surface conditions only, were taken, and, although much progress was made in the study of the development of different types of weather and in the application of the results of this study to forecasting, yet it was very soon realized that the lack of knowledge as to changes taking place in the atmosphere above the earth's surface constituted a severe handicap. As rapidly, therefore, as funds for the purpose were made available, action was taken to overcome this handicap by the establishment of stations at which free-air observations could be made by means of kites and balloons. Observations along this line were begun by the Weather Bureau about 25 years ago. At first kites only were used.



© Photo by W. R. Gregg.
Launching sounding balloons at Avalon, Santa Catalina Island, California

The history of kite flying is very interesting but it is impossible to go into the subject to any great extent here. So far as known, the first kite was flown by a Chinese General, Han Sin, about 2200 years ago. It was for a time used in war, being employed by the inhabitants of a besieged town to communicate with the outside, but later it seemed to degenerate into a mere toy. Twenty centuries later William Wilson at Glasgow University and Benjamin Franklin at Philadelphia first used the kite as a means of upper air exploration. Little more is heard of it until about 1890, since which time rapid strides have been made. The so-called box type of kite is the one in common use at the present time. It is about 7 feet square and about 3 feet high, and is made of spruce framework covered with a good quality of cotton cloth. Kites are attached to piano steel wire of small diameter but high tensile strength, and this wire is paid out from a steel drum which is operated by a variable speed motor, the entire apparatus being housed in a small circular building so mounted on a turntable that it can be easily turned in any direction, according to the wind conditions prevailing at the time. As a rule, several kites are used in tandem in order to lift the wire. The head kite carries a light aluminum instrument, called a meteorograph, by means of which the changes in pressure, temperature, humidity and wind at various heights are continuously and automatically recorded.

© Photo by W. R. Gregg.
Launching a Weather Bureau kite

For exploring the air to greater heights than can he reached with kites,

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British Dirigible R-34 in the daytime. During the flight of this airship from and to England and during 3 days' stay at Mineola, L. I., in July, 1919, the Weather Bureau kept the ship's commander constantly informed as to current and expected meteorological conditions at the surface and at various heights

so-called "sounding" balloons have been used. Made of pure rubber, filled with hydrogen and carrying meteorographs similar to those used in kites, but somewhat lighter, these balloons have given us information of great interest and value to heights of 15 to 20 miles.

Another method of upper air observation, in this case of wind conditions only, consists of sending up very small rubber balloons, usually referred to as "pilot" balloons, and observing them through a theodolite. These balloons are originally from 6 to 9 inches in diameter but are filled with hydrogen until they have a diameter of close to 30 inches. They are then set free and ascend at a rate of 600 to 800 feet per minute. The theodolites through which they are watched consist principally of a telescope and two graduated circles, by means of the readings of which the balloon's horizontal distance from the observation point and its position with reference to a north and south line are accurately determined. With these data at hand, the wind direction and speed at various heights can be quickly computed.

All of the methods, above briefly outlined, have certain limitations. Thus, kites cannot be used in very light winds, nor can the records be computed until the flight is ended. Instruments attached to sounding balloons are not usually found in time to furnish data of current value. Pilot balloons, on the other hand, although not subject to these restrictions, cannot be observed in or above cloud layers. On clear days, though, they can be followed by means of theodolites well above 5 miles, occasionally above ten miles.

Experience has shown that each method has its own particular place and importance. Kite records have enabled us to determine and publish, for heights up to 3 or 4 miles and for all parts of the country east of the Rocky Mountains, the average and extreme conditions of pressure, temperature, humidity, density, and wind, by months, seasons, and the year and for different types of weather at the surface. Special attention has been given to winds, and these have been classified according to surface directions and their characteristics as to change of direction with altitude, increase in velocity with altitude, frequency of different directions and speeds, etc., have been determined and presented in tabular and graphic form.

With sounding balloons this study has been carried to much greater heights, though in less detail, because of the smaller amount of data at those heights.

As a result of these studies the Weather Bureau was able, at the beginning of the War, *i. e.*, the United States' participation in it, to furnish just the kind of information most needed by the War and Navy Departments in connection with the development of aviation and tests on the firing of projectiles. More recently, at the request of the National Advisory Committee for Aeronautics, a report on "Standard Atmosphere," based on all kite and sounding balloon data thus far accumulated, was prepared and published. It contains average values of pressure, temperature, and density for summer, winter, and the year and for all altitudes up to 65,000 feet. These values supply a need that had been long felt in connection with aerodynamic tests, construction of altimeters, etc.

A further study of kite and ballon data has been made during the past two years with a view to perfecting a method of constructing daily upper air pressure maps. The practical application of this study is still in its preliminary phase and little of definite character can as yet be stated with reference to it, but the promise is exceedingly bright. That an intimate relation exists between upper air winds and surfaced weather types is certain. Insofar, therefore, as the upper air maps are reliable, (and they will become increasingly so with added data and study), they will be of definite value not only in forecasting for aviation but also in predicting the direction and speed of movement of storms and therefore in forecasting surface weather.

From the foregoing remarks, it is apparent that the work with kites and sounding balloons is largely of an investigational character, designed to increase our knowledge of the char-

The R-34 at night

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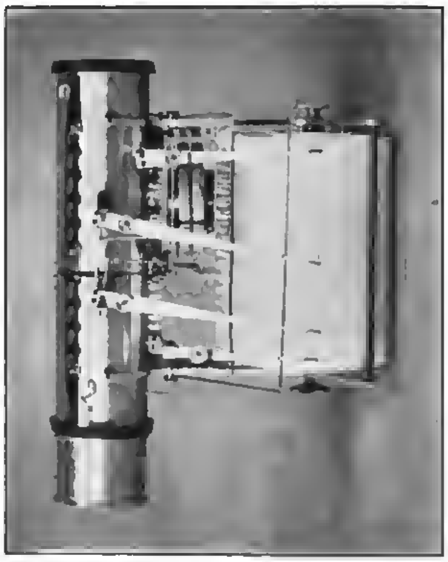
acteristics of the atmosphere, of laws governing storm movement, etc., and thus increasing and improving our bases of forecasting. Aviation needs this knowledge and is benefited by it. But aviation needs also, in a very vital sense, information as to what the conditions are now, and that changes are likely to take place in the next few hours. At the present time pilot balloons are the sole means whereby this need for *current* information is supplied. The observations themselves have already been briefly described. It remains to indicate how they are made quickly available for the information of aviators.

The Weather Bureau has now in operation, 6 fully equipped, first class aerological stations, at which both kites and balloons are used, and 9 others where observations with balloons only are made. There are also available for its use, the balloon observations made at about 25 upper air stations that are maintained at flying fields by the War and Navy Departments. These observations are made twice daily and for the most part, are quickly computed, coded and telegraphed to District forecast centers at Washington, D. C., Chicago, Ill., and San Francisco, California, where they are charted, studied in connection with the complete system of surface reports already discussed, and used as a basis for aviation bulletins, issued for the 14 zones into which, for this particular purpose, the United States has been divided. The bulletins indicate briefly current and probable future conditions of cloudiness, visibility, wind direction and speed, and in many cases the best altitudes for flying. They have been furnishing these bulletins by telegraph or telephone twice daily since December 1, 1918, to the Army and Navy Air Services, to the Aerial Mail Service and to others requesting them. In 1921 there was inaugurated, in addition to the telegraphic and telephonic dissemination above indicated, a special service by radio in co-operation with the United States Navy, Twice-daily bulletins, containing surface weather observations from regular stations, upper air observations from aerological stations maintained by the Army, Navy and Weather Bureau, and a summary of weather conditions, forecasts, and warnings, are broadcast from Arlington, Va., Great Lakes Naval Station, and San Francisco Naval Station. Through this medium any flying field and any independent aviator, provided with a receiving set, can thus without appreciable expense or effort, be kept advised as to weather conditions in any part of



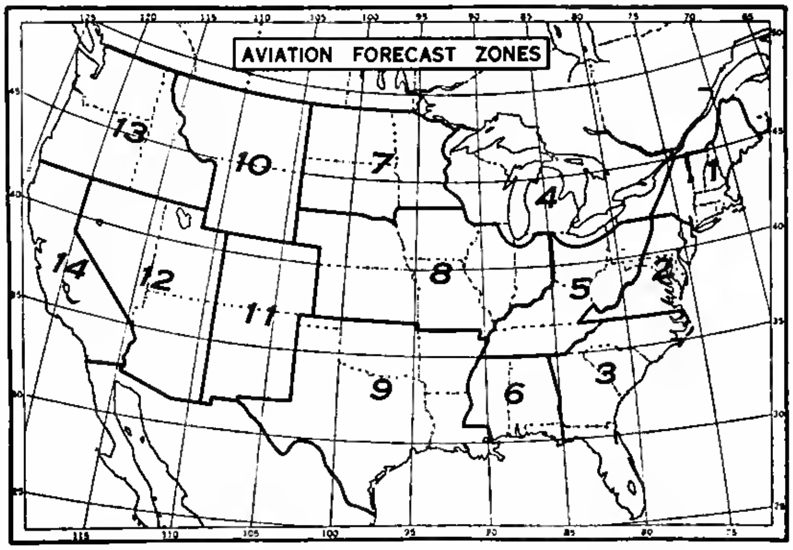
Kite Meteorograph. Records pressure, temperature, humidity and wind speed

the country.

In a report by the Manufacturers Aircraft Association and the Aeronautical Chamber of Commerce to the Secretary of Commerce (see Aircraft Year Book for 1922, page 42), it is stated that "Obtaining information of weather conditions on a cross-country flight ranks in importance with the inspections of the engine and plane, and it is highly desirable that, in peace times, except in emergencies, no cross-country flights should be undertaken until available information of conditions on the way has been obtained." This is merely one among many expressions of a sentiment that is universal. Insofar as its appropriations have permitted, the Weather Bureau has endeavored to supply the needed information in every case. In addition to its daily service, already briefly outlined, it has participated actively in numerous aeronautic undertakings of a special character. Perhaps the most notable instance of this type of service was the trans-Atlantic flight of the NC seaplanes in May, 1919. During the months preceding this event, the Weather Bureau worked in close co-operation with the Navy to determine the best time of year, all factors considered, for the flight, and during the flight itself and for several days just prior to it, thrice-daily forecasts were issued from Washington. In addition a representative from the Weather Bureau and one from the Navy were stationed at Trepassey, Newfoundland, received and charted meteorological reports from American and European stations and from special observation ships at sea and gave information and advice relative to conditions for the longest part of the flight, that from Trepassey to the Azores.

A similarly intensive service was rendered in connection with the trans-Atlantic flight in the British dirigible R-34. It is interesting to note, as indicating the importance attached to meteorological advice by the British authorities, that a trained meteorologist, Lieut. Guy Harris, was one of the airship's crew. During the voyage itself, he received and studied radio weather reports and gave advice to the commander.

U. S. DEPARTMENT OF AGRICULTURE.
WEATHER BUREAU.



Forecasts of weather conditions and of wind at surface and aloft are issued twice daily for the benefit of aviators. They are made at 9.30 a. m. and 9:30 p. m. (75th meridian time), and cover a period of 12 hours, beginning at noon and midnight, respectively.

The forecasts for the various zones are prepared and issued from forecast centers of the Weather Bureau as follows:
Washington, D. C.: Zones 1, 2, 3, 5, 6, 9, and 11.
Chicago, Ill.: Zones 4, 7, 8, and 10.
San Francisco, Calif.: Zones 12, 13, and 14.

(Effective April 15, 1922)

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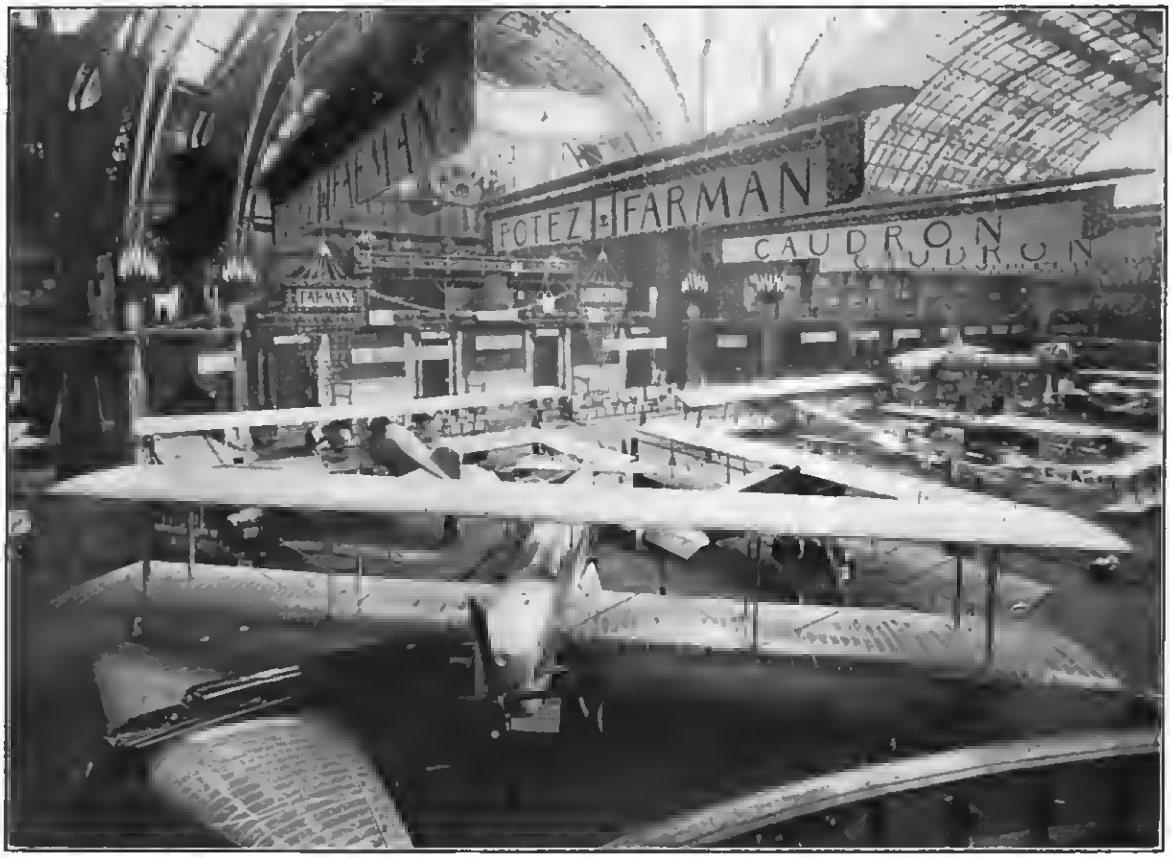

The new Farman Transport plane with one 600 h.p. motor. The single motored type is rapidly replacing the old twin-motored type in Europe

The French Aero Salon

By Grover Loening, B. S. C., A. M., C. E.

TO many of us who have become accustomed, during the past two or three years, to look upon the French Salon largely as an exhibit of the development of commercial aeroplanes, the Salon this year was something of a shock because of its distinctly military nature. The commercial aeroplanes, particularly of the larger sizes, were in practically every case merely bombers in disguise, and when one finally saw the Farman Goliath in its real colors, equipped as a night bomber, one readily realized that the large subsidies given by the French government for commercial aviation had a very sound and a very practical military basis.

Discussion with some of the more prominent officials soon disclosed that the government, as well as the industry, in France, had a very definite political purpose in making this Salon as much of a demonstration of the greatness of French aviation as possible in order to show the world, at the particular time of the Lausanne and Paris Peace Conferences, that French military aviation was an international force of great power, rapidly taking its place beside the political power of the British Fleet.

The new machines exhibited, the engines, the equipment, etc. were almost entirely military and the imposing array of single seater pursuit planes, two seater reconnaissance planes and torpedo planes gave an unmistakable war aspect to the entire Show.

Another point which shows the confidence of the French constructors in their products is that practically 85% of the machines exhibited have never flown. This was also more or less the case last year, and the interesting point to determine was what percentage of the unflown machines at last year's Salon had flown during the year. It was found on investigation that only 10% were successful. Therefore, much of the beautiful workmanship and many startling disclosures of the Salon must be taken with due reserve because of the lack of proof by actual test.

Outside of the military feature, the most striking tone of the salon was the stupendous effort for metal construction. Curiously one is not impressed by this step as revolutionary, but merely as indicating another way to build an aeroplane if one happens to run short of lumber. The general trend of the better constructors is, of course, towards linen-covered wings over metal frames, as the linen covering furnishes an excellent means of deadening the crystallizing effects of vibration, and incidentally, makes it possible to build a duralumin frame machine for the same weight as wood. But the unfortunate feature of duralumin construction of having to be riveted so much makes the quantity production characteristics of the French type of metal construction almost hopeless. The amount of hand work involved in the elaborate structures displayed would ruin any American factory where labor cost is so high in comparison to the French cost.

In some instances, there is a tendency towards steel, as for instance, in the Schneider, where the spars of the wings are made of steel with numerous steel struts; and other in-

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stances where duralumin has given way in the interests of production to the use of steel.

In general, however, this craze for metal appears to be something of a fashion to which the French are as likely to succumb in aeroplanes as they are in women's dresses. Some of the really sound constructors like Farman with long and practical experience still prefer to build of wood and there are many very intelligent French engineers who now admit that instead of abandoning wood so suddenly, there is much to be done in simplifying the type of construction in which wood is used so as to eliminate glued joints, veneer and other flimsy details that represent the real weaknesses of wooden construction.

Among foreign planes exhibited at the Paris Show, were the Handley-Paige torpedo plane, the Savoia flying boat and the Koolhoven two-seater pursuit monoplane. The latter machine in type is distinctly reminiscent of the old Loening M-8 which was built in 1918.

The Handley-Paige torpedo plane is, of course, distinctive due to the weird slot arrangement of the leading edge which certainly slows the machine down to an extraordinary extent, unfortunately not only for landing but also for flying. One is inclined to wonder what vibration effects are going to be found from this arrangement and also to observe that the structural details of the machine itself are not especially rigid.

The Savoia flying boat looks needlessly heavy and does not possess a very comfortable seating arrangement. The finish and details are thoroughly first class. Throughout the Show, there is no question that the most practical looking flying machines are the Farmans. No great effort is made either to be original or to follow the fashions. There is little waste of weight in their construction and their installations are neat and simple. The details appear very easy of production (for example, the square cutting off of the wing tips) and one is reminded of the very competent remark of C. G. Grey, editor of "The Aeroplane", that apparently the uglier an aeroplane looks, the better it flies.

One, therefore, looks forward with interest to the reports of the flying tests, if any, of the new Nieuport Sesquiplane, the DeMonge monoplane, and the Ferbois-Bernard Cantilever metal monoplane, all of which are distinctly works of art as exhibited in the Aero Salon—well streamlined and very graceful looking.

Incidentally, the Nieuport Sesquiplane is completely equipped from a military standpoint and also has the Rateau supercharger installed in a very workmanlike manner.

One was advised, confidentially, that none of the really new and important military features of the French Air Service were disclosed at the Salon, but a subsequent examination of the military planes at various fields and factories showed that the details exhibited in the way of armament, equipment, installation, etc., were all fully up to the latest practice in the French Military Air Service.

Even though there were a great many machines exhibited, one could not help but be impressed with the fact that only a few new trends of construction were being adopted by many people, so that if the exhibit had only been of about five machines, let us say, for example, the Breguet Leviathan, the Nieuport Sesquiplane, the Liore Flying Boat, the Farman Reconnaissance Plane and the little Potez Touring Plane, one would have gathered most of the development of the technical features of French Aviation during the past year or so.

Many of the elaborate body features of very comfortable upholstery

In the foreground, the neat Cams flying boat used by the French Navy for school work, and in the background the Schneider bomber, which is incidentally equipped with the new Lumiere steel propeller

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and lace curtains applied to commercial aeroplanes are strictly Salon tricks because on the air lines, themselves, all such trappings are quickly disposed of. The popularity of the 150 h.p. Hispano for commercial work is very evident.

Among the technical developments, one was prompted to inquire, and with little degree of success, when a "semi-cantilever" monoplane either becomes a cantilever or does not, and exactly what a "Sesquiplane" really is. From the Nieuport standpoint, it appears to be a perfectly good, rigidly braced strut monoplane, with a trick wing structure housing the landing gear axle.

In the case of the Breguet Type 19 Bis., a quite orthodox biplane (not exhibited at the Salon), with a lower wing of about 20% less area than the top wing, is everywhere advertised as a "Sesquiplane." One might as well call a JN-4 a sesquiplane. In fact, the answer is, of course, the same characteristic above cited of running after fashions. The popular feeling relative to a monoplane induces the constructors to try to disguise their highly successful monoplanes such as the Nieuport by calling them something else. The fact remains that as far as any trend in design is concerned, not only the Salon but the development of new planes throughout Europe, such as the DeWoitine, the Wibault pursuit plane, the new Handley-Paige single seater, the Koolhoven, the Dornier and some new Italian planes—all perfectly good monoplanes—show a very distinct trend in the smaller sizes of machines towards this type.

As a matter of fact, the author has held and continues to maintain that the sharp distinctions between monoplanes and biplanes are entirely unnecessary as the question of the adoption of a monoplane or a biplane for a particular design is entirely a question of balancing various features against each other. In many instances, particularly of larger machines, a proper analysis resulting in the definite conclusion that a biplane is far more practical and in other instances, such as the Loening Air Yacht, the reasons for adopting the monoplane type has much more to do with seaworthiness and visibility than with aerodynamic characteristics.

Many constructors in Europe are coming to this point of view, particularly Fokker, who has now completed machines that can be monoplane or biplane in a few minutes so that the most opinionated of test pilots may be satisfied instantly on the particular whim in this regard. A good monoplane is more difficult to build than a good biplane, simply because more good biplanes have been flown during the past few years and more is known about them.

In conclusion, it is extremely gratifying to note that the display at the Paris Salon, when compared to our developments in this country, does not indicate that we are in any way behind the times in American Aviation. In fact, it is quite the contrary because we are not swayed so easily to extremes and we continue to develop real flying machines that capture world's records instead of the more beautiful "objets-d'art" which so impress the layman at the Aviation Salon.

Incidentally, at a meeting of constructors that was attended, it was made clear that the industry itself, from a business standpoint, could never afford to hold such a Show as this Salon, and that the actual business derived from it was not very great, excepting in perhaps stimulating a few foreign orders which would probably come through anyhow, so that there appears to be at least some argument, if not some question, on the desirability of holding the Salon next year.

The political importance of the display, however, was undoubtedly of great value to the French nation, as they are without question, the greatest military air power by a large margin.

Airscape of Venice, photographed from a dirigible

Reorganization of Aeronautics in Italy

By Lieut. Colonel A. Guidoni. Air Attache. Italian Embassy at Washington

Lieut. Colonel Guidoni has just been appointed by Premier Mussolini, Chief of the Technical Division of the General Bureau of Commercial Aeronautics. His large circle of friends in the United States, and particularly in the air services of the Government, will deeply regret his departure from Washington, while extending sincerest good wishes for success and great achievements in his new post.—Editor.

AFTER some weeks of careful study of the aeronautical situation in Italy, Premier Mussolini on January 24, personally took over control of all the nation's air activities, thus fulfilling the promise of reorganization made prior to forming the new Government. The Premier thereupon created a Commissario di Aeronautics, himself taking charge as Commissioner, and appointing the Hon. Aldo Finzi to the post of Assistant Commissioner. The latter is the executive head of the coordinated and correlated aerial establishments of the Government and is under direct authority of the Premier, who as Commissioner will, of necessity, be unable to devote much time to aeronautics.

The outstanding characteristics of the new organization are that the Commission is wholly independent of the Army and Navy Departments and that it will control both military and commercial aviation. In other words, the plan of organization gives Italy a separate air service. The War Department had endeavored to retain control in a Bureau of Aeronautics operating under the Assistant Secretary of War, but this plan was eventually abandoned in working out the new scheme of combining all air activities under a single responsible head.

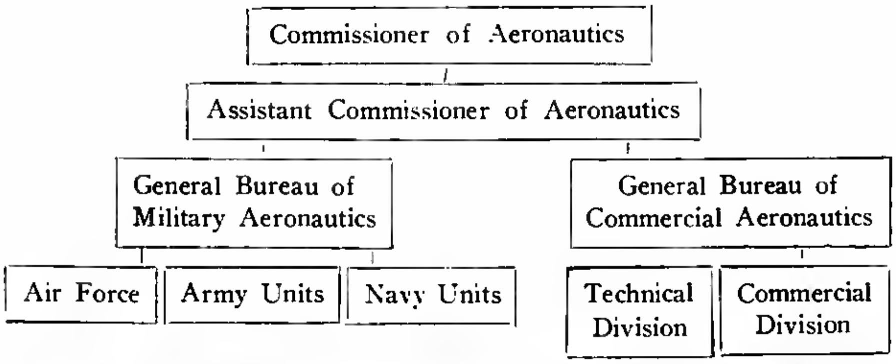
In effect, aeronautics in Italy is now an independent department and will have the same administrative and political standing as have other departments. The Commissioner or his Assistant will also participate in the meetings of the Cabinet.

Assistant Commissioner Finzi is an aviator who had much experience in the service with the Army during the World War. He was attached to the Air Squadron commanded by Gabriel D'Annunzio and took part in the great raid over Vienna. All aeronautical bodies in Italy are looking to him with confidence in his ability and purpose to foster, encourage and advance the air interests of his country.

Colonel Moizo, who was a member of the Italian delegation at the conference of armaments in Washington, will be chief of the General Military Bureau in the new Department. Commendator Mercanti has been appointed chief of the General Commercial Bureau.

Among the initial functions of the General Military Bureau will probably be the conduct of an exhaustive study of plans for an air force, which will embrace the organization, instruction and government of all tactical units which are operated by the Army and Navy. The General Bureau of Commercial Aeronautics will have a division that will handle the establishment of air routes, licensing of pilots, granting of airworthy certificates for aircraft, etc., and a technical division which will be in charge of all research, experiment, production work and material supply to all branches of the Army, Navy, and separate air services. This technical division consequently will be of great importance in the department.

The new plan thus presents the following graphic outline of organization:



Lieut. Colonel A. Guidoni

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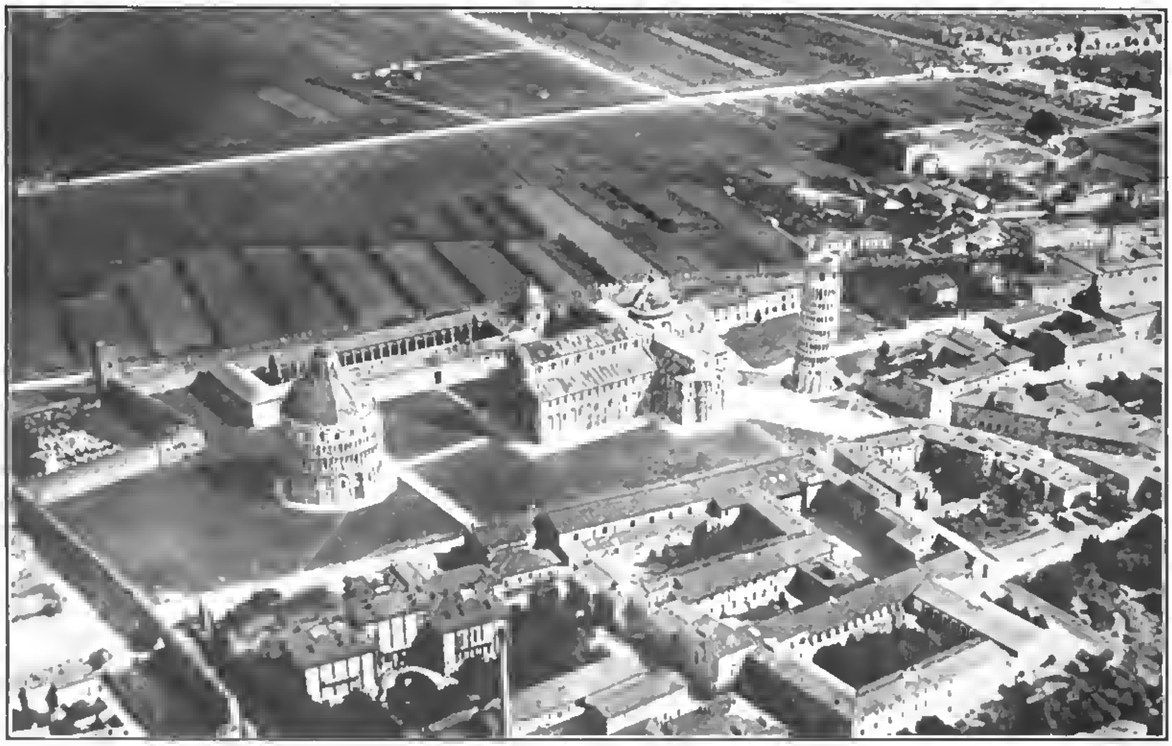
Airscape of Vienna under propaganda bombardment by the Italian air forces

According to recent information, appropriations for aeronautics in Italy amounting to 27,000,000 lire ($13,000,000) have been granted for the next fiscal year. The program provides for the building of 720 aircraft of all types.

Italy has more and more concentrated upon the development of commercial aviation. To this end it is recognized that the essentials of such a purpose are (1) to develop and maintain a sound aeronautical industry; (2) to develop and maintain a reserve of personnel; (3) to develop such transportation services which will integrate the European international air trade, taking advantage of the fact that Italy in this transportation development is the natural bridge of the Mediterranean Sea.



Airscape of Pisa

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Helium in the National Defense

By John E. Raker, Representative in Congress from California

Hon. John E. Raker, Representative in Congress of the Second District of California, has represented that District since the 62nd Congress and was reelected for the 68th Congress. He is a member of the following important committees: Immigration and Naturalization Committee; Woman Suffrage Committee; Irrigation of Arid Lands, and Public Lands Committees. Mr. Raker has been active in behalf of constructive legislature dealing with Aviation as it affects the United States.—Editor.

IN THE House Committee on Public Lands, which is generally engaged with legislative matters related to homesteads and preemptions connected with the public domain, we have just completed the hearings on the bill authorizing the conservation, production and exploiting of helium gas. Now, the situation of the Committee with reference to expert knowledge of this mineral resource which is bound to be a most important factor in the development of commercial aeronautics and in the aerial defenses of the nation, was somewhat analogous to that of the general public, although the members of the Committees had, of course, a closer contact with the operation and navigation of airships because of such navigation and operation in the vicinity of Washington. But as to the lifting power of such ships and the distinction between gases, information has been rather meagre.

We have heard of helium gas in rather a general way and usually when an accident has happened to an airship using hydrogen, when it has been emphasized that the resultant fire, as in the case of the semi-rigid Army airship Roma, would not have occurred had helium been employed as the lifting element in the ship. And we have been expertly informed that the United States has practically a monopoly of helium; that under adequate provisions the extraction of helium from natural gas will be done at a reduced cost comparable with the cost today of hydrogen and the wastage of hydrogen in use.

When the Committee on Public Lands, therefore, made inquiry into the purpose of the Bill H. R. 11549 introduced by Chairman Kahn of the Military Affairs Committee, and its effect upon the conservation, production and exploitation of helium, the question uppermost in the minds of the members was: "Why has not this great safety element in the operation of airships been adopted for the welfare of the Government and the progress of aerial travel?" Well, we have had our hearings, and the conclusion seems to be that the Government is no less conservative than the people. Helium is something new, just as were sprinkler systems for fire control in buildings. And we can get an estimate of the attitude toward helium from our personal knowledge of many persons who still disregard and resist insurance against fire. If there were not millions of persons of this attitude, our fire insurance companies might save vast sums of money now spent for advertising and solicitation. There you have it: Lack of knowledge as to helium and its uses in airships, and apathy toward the question of the advancement and the conservation not only of this mineral element, but life itself.

I take the attitude, and I believe it to be dictated by right and by common sense, that the United States Government has neither the right nor the privilege of resisting insurance against loss, either to the Government or to the people. That is the plain case as between helium and hydrogen as the lifting element for our American airships.

There is another consideration that makes for apathy as to development of American supremacy in the air, and that is the very newness of the art of airship communication despite the war stories of the remarkable accomplishments of the Zeppelins. It is new to the United States so far as being a common carrier of the air. But if the great airship the Navy is building at Lakehurst, N. J., filled with helium and operated and navigated as the first of our important air cruisers proves a success,—

Hon. John E. Raker

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as I am convinced it will prove,—then every American capable of reading his daily newspaper will soon be in possession of the convincing information that the day of absolutely safe aerial travel is at hand. And his interest and trust in airships will thereafter be unshakable.

And that gets us back to the production of helium even if solely for the national defense, were its utility for public convenience (and eventual necessity) thrust aside. We are doing little as a Government in the production of helium for the meagre appropriations preclude the extension of the existing extraction plants and absolutely shut the door to the conservation of the natural resources which must be controlled for the adequate production of helium. The while we are building the airship for the Navy which will require almost all the helium yet stored up,—about 2,250,000 cubic feet,—the so-called Zeppelin reparations airship, which is building in Germany for the United States, is nearing completion and must be flown across the Atlantic filled with hydrogen gas.

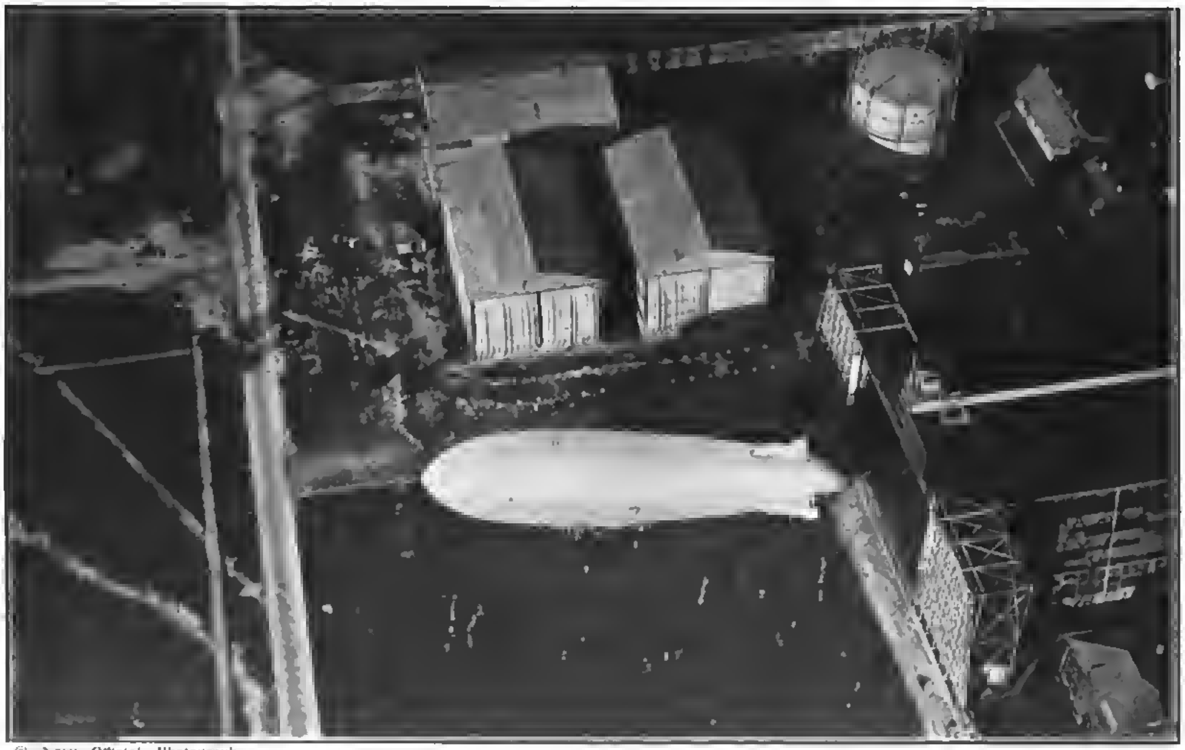
These facts explain more readily than pages of argument the existing condition as between safe helium and unsafe hydrogen. We will have just enough for one ship here, and none for the ship destined to make an oversea cruise of 3,500 miles with its precious complement of United States Navy officers and men. We know what happened to the ZR-2 in England, and in the light of that irreparable catastrophe we have rested content and indifferent to the common-sense demand for the production of helium.

We ought to waste no more time in protecting the Government as well as the individual. We cannot afford to take the chance with the officers and men of our Services who are of necessity the pioneers in this one phase of aerial communication, for we owe it to these brave men to give them every safety element possible in the prosecution of the work of development of air power for the United States.

It is a purely business proposition, this adequate development of the production of helium, just as is the installation in all our modern business buildings and factories of sprinkler systems and fire plugs and fire drills. We have terrible examples before us,— complete loss of men and ships in the Roma and ZR-2 disasters,—and these alone should cry out to us to do our part to make such disasters impossible. And we can do just that in the adequate production of helium gas and the conservation of those natural gas fields which are the source of this wonderful and safe element.

Granted helium airships, operating with the Army on land and with the Navy on sea, we shall have a distinct defensive advantage for the nation, and a guarantee of security for our valued and extensive coast line. Every consideration from the point of view of the national defense and from the fundamental basis of safety not only for our airship operations but the people, converges upon the sound exploitation of helium gas and to the utmost extent of our facilities for production. For helium can be stored and used as required, and it should be so stored against eventuality just as we store any other essential instruments of national defense.

In conclusion, let me state it plainly: On the basis of the airships now in use in the Army and Navy there is a 2,100 per cent loss in the use of hydrogen. That is, the hydrogen must be thrown away after a certain length of use because it becomes a perfect explosive mixture of great hazard. With helium the loss is fifty per cent per annum. There is no room for argument.



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The C-7, the Navy's non-rigid airship, the first in history to be inflated with helium, starting from the Naval Air Station at Hampton Roads, Virginia, on the memorable flight to Washington, D. C. on December 5, 1921

Homogeneous Air Organization

By B. H. Mulvihill

Vice-President of National Aeronautical Association of U. S. A.

THE advantages that are to be derived from uniformity of methods are known all the way along the business line from the one-man shop to the greatest corporation. It is obvious, in scanning the commercial and industrial history of the United States, that the marvelous progress of the nation's business has been due more to the aptness of the American to grasp the advantages of ever-advancing methods, unhampered by restrictions and with a freedom limited only by capability, than to any other influence.

From the early Colonial days our men of business have characteristically faced fact and given it battle. From time to time their struggles were involved because of the complexity of conflicting national interests and desires, as in the Civil War. But, whatever for any period obstructed the freedom of business development, it was only temporary and when removed was followed by a development greater than could have been foreseen when the check to progress was imposed.

There is no need of cataloguing the never halting steps in American business progress through adaptation of tried and uniform methods. We are still primarily concerned, moreover, with progress in transportation and communication in a land so extensive as the United States, for it was the ever-advancing line of communication by railroad and by steamboat which carried the nation, like a Colossus to the goal it has attained in land and sea transport.

We have, after experience in trial and failure, come to the point where there must be departure from the haphazard in the science of air transport, the point which indicates conclusively that the important step is toward homogeneity of aeronautical organization. That step has been taken in the institution of the National Aeronautic Association of the United States of America and, we believe, we are for this reason at the threshold of the greatest advance in air transport, in this twentieth year since man first navigated the air in a power-propelled machine.

The development of transportation has always leaned heavily upon the government, as was the case with our railroads. It has been the same with aeronautics: perhaps it should be said that aeronautics has leaned almost wholly upon the government since the first Wright airplane was purchased for the Army Signal Corps. Today the air auxiliary in the Army and Navy and in the Post Office Department is, in effect, a subsidy to warrant air advancement. Confined and constricted by governmental patronage, and for purposes which are far removed from the commercial utility of this new instrument of transportation, aeronautical development for the benefit of all the people has simply not functioned.

The progress in the air in America has been marvelous, to be sure; but for so favored a land aviation is still in its infancy as a public convenience,—and conveyance. It is to bridge the gap between the wholly inadequate promotion of Government services with meagre government funds and the tremendous potentialities of air transport that the National Aeronautic Association has been founded. Its organized purpose is to command recognition from the business interests of the country for the advantages which will accrue from uniformity in method, in control, in equipment, in all the advantages that have marked the path that has been blazed by American pioneering in the air. The foundation has been laid by the work in aviation under government patronage, and it is a marvelous foundation. It rests now with the National Aeronautic Association to step out from this mark and impel toward an early realization of the business possibilities,—in commerce, in industry and in finance,—of aircraft performance.

The government in the three executive departments utilizing air equipment has gone far; but it could not go to the length and breadth of the country, for example, in the important essential of establishing air terminals and stations. Some work along this line has been done under the spur of needs for the national defense, but landing

Bernard H. Mulvihill, First Vice-President National Aeronautic Association

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fields that rarely are used because of the rarity of government fliers, soon fall into disuse and are a waste of the money spent in installing them.

In this one direction the plan and purpose of the National Aeronautic Association attain an importance that is incalculable, for until the field facilities are at hand the network of air lines is an impossibility. Here is a real ground-work in a double sense. It must be done expeditiously as well as expertly, else there will be nothing in the work either for aeronautics or for the business man. And herein uniformity of method will supply the advantage the operator of the transport in the air must have to make certain the success of the whole scheme of air transportation.

If there is lacking control, backed by Federal authority, as provided in the Wadsworth bill which places control in a Bureau of Aeronautics in the Department of Commerce, commercial air transport cannot depart from its present state of instability. That is not said in a spirit of criticism, for we have only to recall the pre-control days of land and water transportation with its cut-throat competitive scrambles for business that became a scandal.

If equipment and its inspection are to go on in happy-go-lucky, hit-or-miss fashion, even a President of the United States will be outraged not once, as recently instanced, but many times, for Washington is evidently destined to be the goal of both the so-called gypsy of the air, as it is the Mecca of all good Americans. If the contests which are the beacons of American enthusiasm and invention were to run wild; well, the sport would soon degenerate into the category of orgies.

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Katharine Wright christens the flying boat "Wilbur Wright". Left to right are:—Percy MacKaye, poet and playwright, Vilhjalmur Stefansson, Arctic explorer, Orville Wright and Miss Katharine Wright

So, there has been a real need for an organization upon broad-gauge national lines, affiliated with forward-looking aeronautical organizations in all lands and particularly in the extensive field of air progress in Europe, that would hold aeronautics true to the line along which lies the widest and most practicable achievements.

The groping stage has been passed; the way out to national supremacy in the air, in every direction possible of development, is through the wide open door of the National Aeronautic Association. The way in is as open and by the enrollment of thousands of Americans who are keenly alive to the possibilities of air transportation and to the logic and right of sound air policies, and who have the vision to see that by development of these possibilities America will not only gain air supremacy but retain its commercial supremacy, the work is going on at a pace which even the most sanguine of its projectors dared not hope for. The bridge between the government on the one side and the manufacturer and operator on the other side has been stoutly constructed to bear the traffic of our common national interests in aeronautics that we are confident will lead eventually to even the most isolated hamlet. The National Aeronautic Association realizes its responsibility, and it is firm in the trust that it will fulfill effectively the functions involved in its work.

Dawn of A New Era in Passenger Transportation

By C. P. Burgess

Aeronautical Engineer Bureau of Aeronautics U. S. Navy

Mr. C. P. Burgess, is one of the world's foremost airship engineers, having represented the Navy Department in England, during the investigation and hearings concerning the design and manufacture of the rigid airship ZR-2, and the causes which led to her destruction. He was intimately concerned with the design of the ZR-1, the Navy's rigid airship, now being built at Lakehurst, N. J. Mr. Burgess is at the present time in the Bureau of Aeronautics of the Navy Department, engaged in engineering in connection with the Navy's airship program.

Editor

FOR countless ages the power to cleave the air upon wings seemed to earthbound man so desirable, and withal so sublime, that the possession of wings has been esteemed an attribute of gods and angels. At times some bold and perhaps irreverent genius attempted to make for himself wings in the image of the beasts of the air; but in spite of the apparent ease with which the large soaring birds maintain themselves aloft upon outstretched and motionless wings, all efforts of man to imitate them failed utterly.

Nature presents to man not only the spectacle of the flying bird, but also clouds and smoke floating upon the atmosphere; and while the largest bird weighs only a few pounds, a single cloud may contain thousands of tons of water. The startling idea of imprisoning a cloud of smoke and

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floating upon it in the air occurred to a Frenchman in the 18th century, and from this idea was born the hot air balloon in which man first ascended from the earth.

The development of mechanical power during the 19th century culminated in the marvelously light and powerful gasoline engine of our times. Equipped with this engine, man found himself able to fly upon wings, or to construct veritable ships of the air, capable of navigating the atmosphere by mechanical power to any desired objective, and yet floating as independently of that power as the clouds or as ships upon the seas.

The airplane, like the bird, is swift, but limited in size, while to the airship there appears to be almost no limit of dimensions except financial considerations. With the airplane, increasing size offers no gain in economy of power, for at a given speed, the engine power required is directly proportional to the weight of the airplane and its load. Moreover, the useful load which an airplane can sustain is found to be less in proportion to the gross weight in very large machines than in smaller ones. Finally, the difficulties of landing and the necessary size of the landing field are found to increase with the dimensions of the airplane, so that the dangers entailed in a forced landing increase also.

For the airship, on the other hand, the advantages of increasing dimensions are manifold. The buoyancy derived from the air is directly proportional to the volume of the airship, and the volume in turn proportional to the product of three dimensions, length, breadth and depth. Thus, if we double the dimensions of an airship we get eight times as much buoyancy or lift. The lift derived from a wing is proportional to the area, and this is proportional to only two dimensions, so that to double the dimensions of an airplane gives only four times the lift. The resistance of either an airship or an airplane is also proportional to the area, so that to double the dimensions of either type of aircraft is to multiply the resistance and the power absorbed by four. It follows that with increasing size the airship becomes more economical in power and fuel consumption, and also less bulky in proportion to its weight, compared with the airplane. Finally, increasing size has for the airship the advantage of reducing the proportion of the structural and machinery weight to the gross weight. It is clear, therefore, that merely by the expedient of increasing the dimensions, it is possible to increase indefinitely the useful load, the speed, and the range of flight without refueling an airship, while in the airplane increase in size presents no such advantages.

All history teaches that facility of communication is one of the most potent physical aids to the progress of civilization. The development of aircraft gives to the world not only the most rapid of all means of transportation, but also, for the first time, it is possible to voyage in all directions almost regardless of terrain, and independently of permanent ways. By analogy of history, aircraft should minister to new strides of civilization.

The new era will fail, however, to fulfill its bright promises unless safety can be assured. It appears impossible that the danger of forced landings in airplanes can ever be wholly eliminated, and the forced landing of a large passenger-carrying plane in darkness or fog on anything but on a favorable terrain is unpleasant to contemplate. The large airship, on the other hand, may have a dozen or more engines and be capable of good speed with only a third of them in operation, so that the danger

The first helium filled airship in the world, the Navy Blimp C-7 over "ellipse" at Washington

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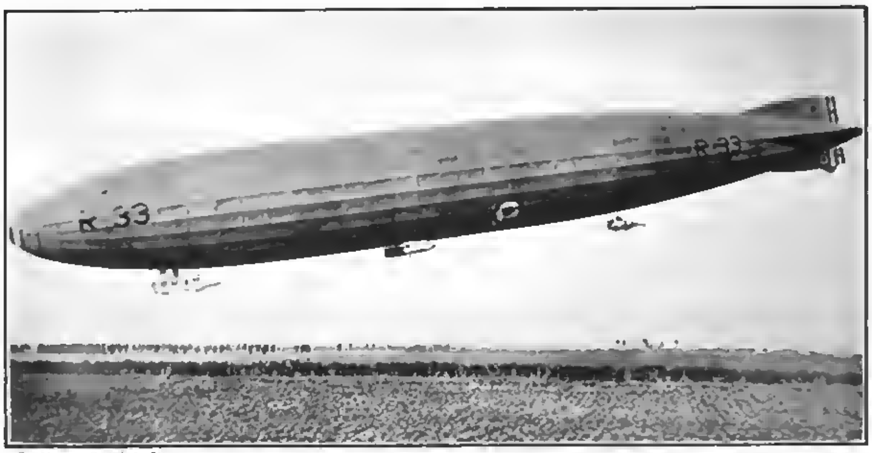
An early type of rigid airship, the R-26, at Hendon, England. It will be noted that this is a straight sided ship lacking the stream lines of the R-33 and R-34

of a forced landing due to engine trouble is eliminated.

It is sometimes thought that the airship resembles a toy balloon and collapses when punctured. This is only true of the small non-rigid airship consisting of an envelope of fabric maintained in shape by gas pressure. The large rigid airships developed in Germany, and later in England, have structures of aluminum alloy and steel wire, which maintain the form independently of the gas pressure. Within this structure there is a multiplicity of gas bags like the water tight compartments of a ship, so that the complete loss of gas in one, or even in several bags, may be compensated for by discharge of ballast or fuel, and by no means entails a forced landing. Moreover, the gas pressure in these bags is so low and the volume of the gas so great that the rate of loss of gas through a fairly large vent, is small, and affords ample time to effect emergency repairs while in flight by application of an adhesive patch to the wound. Even if a forced landing should occur with an airship, the fact that it can be made at no speed, instead of from 45 to 60 miles an hour, necessary with an airplane, means that injury to the passengers is unlikely, although the airship herself may subsequently break up if the wind is strong and a large number of men to hold her are not available.

The recent loss of the British rigid airship R-34 bears eloquent testimony to the safety of travel in such airships. By an error in navigation the R-34 collided violently with a mountain in the darkness of the night. For an airplane this disaster would probably have involved the death or serious injury of all on board. In the R-34 the crew were unhurt, but the airship suffered structural damage and three of the five engines were placed out of action. Crippled as she was, and against strong adverse winds, the R-34 made her way back to her base, which she reached about twelve hours after the accident. A successful landing was made, but owing to the violence of the wind, the landing party was unable to get the airship into her shed. She was then moored to the ground by three wires in exactly the same manner that she was secured at Mineola, Long Island, upon the occasion of her famous round trip voyage across the Atlantic in the summer of 1919. This is admittedly a temporary expedient and no more desirable in a high wind than anchoring a disabled steamship off a lee shore in a gale. The R-34 jerked at her mooring lines until large holes were torn in her, and from loss of gas she began to strike against the ground, gradually demolishing the whole forward half of the vessel. The important point is that in none of the links of disaster was anyone injured, and recent developments have made each link avoidable.

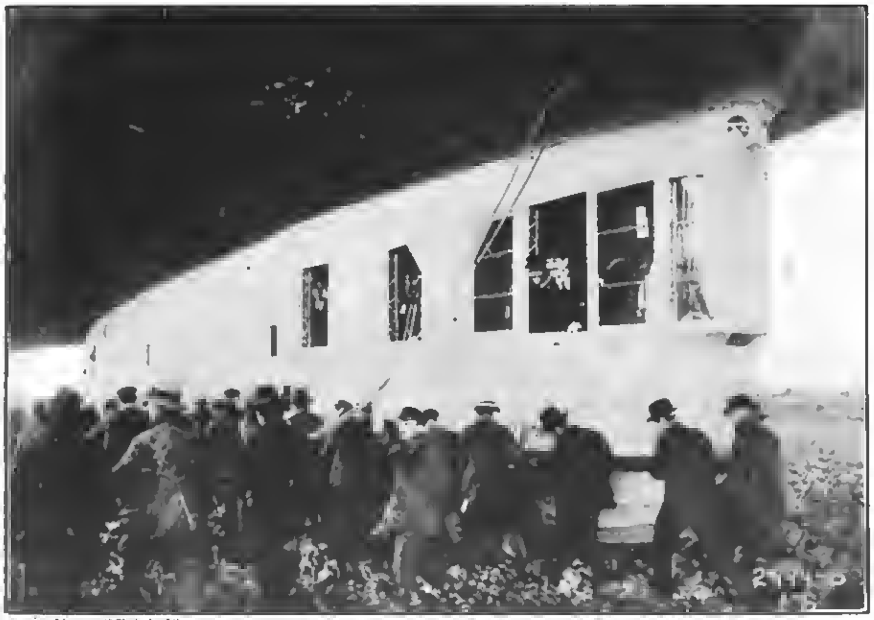


© Navy Official Photo

The R-33 at Hendon, England, on her trial trip

The primary cause of the loss of the R-34 was an error in navigation by which the airship went 60 miles off her course. The radio direction finder enables an airship pilot to obtain the bearing of two or more land stations at any time, so that he can find his position on the map with exactitude, and errors of navigation are, therefore, now avoidable.

By far the most important recent development has been the mooring mast. A great drawback to the use of the airship hitherto has been that at the beginning of every voyage the vessel must be taken out of a shed,



Navy Official Photo

Passenger car of the post-war Zeppelin "Bodensee". The ship has just landed on one of her periodic flights from Copenhagen to Berlin

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and at the end of a voyage it must be put in again. The cost of an airship shed is very great, and a large force of men is required to handle an airship entering or leaving the shed. No means of mooring an airship outside its shed existed, except the unsatisfactory expedient of the three wire system used with the R-34. Attempts were made to solve the problem by securing the bow of an airship to a steel lattice mast or tower called a mooring mast. For long the experiments were disappointing because it was found that the airship was subject to severe jerks and strains while being hauled to the mast. Now the difficulty has been overcome, and, in England, the R-33, sister to the R-34, has for months been riding to a mast in all weathers, and leaving or coming up to the mast with the services of only a few men on the ground. This most serious problem solved, the rigid airship may be operated in any weather without fear that she will break up at her journey's end because of inability to enter her shed. Airship sheds will be necessary only at the principal terminals for docking purposes. Mooring masts should be distributed about the country and maintained as a Government charge, like lighthouses upon our coasts. In peace and in war they will be an invaluable asset to the nation.

An airship inflated with hydrogen is exposed to the terrible danger of fire in the air. Yet this danger is much less than is generally supposed, for hydrogen must be mixed with air in order to burn, and even incendiary bullets, which finally stopped the German airship raids upon England, will set fire to an airship only when fired into the gas bags in great numbers until escaping jets of hydrogen are ignited by incendiary bullets following close behind others. German airships have been struck by lightning so that the metal girders were fused in places, but the gas was not ignited.

With helium as a buoyancy medium, even those dangers are eliminated.

The primary danger of fire in all types of aircraft is from gasoline vapors around the engine. Airships require less power in proportion to weight than airplanes, and it seems probable that in the near future as safe and sturdy heavy oil engines will be developed for airship use, eliminating the dangers of gasoline vapors.

Finally with heavy-oil engines and the use of helium, the last serious dangers to airships will be removed, and travel by air will be safer as well as swifter, more comfortable, and infinitely more interesting and inspiring than travel of any other sort.

Standardization and Aerodynamics

SINCE the latest article on Standardization and Aerodynamics by William Knight has been published in the December issue of AERIAL AGE, we have received a number of letters commending us for the campaign that we have started in July 1921 in favor of an effective international cooperation in aeronautical scientific and research work.

Letters of appreciation of the timely suggestions contained in the series of articles on this subject which we have published during the last two years have been addressed to us by the League of Nations, by the National Advisory Committee for Aeronautics, by the National Aeronautic Association of the U. S. A., by aircraft manufacturers, officials of foreign governments, European research laboratories and the aeronautical press.

The following editorial comment appearing in the January 17th issue of "The Aeroplane" is a complete endorsement of our suggestions and we are glad to reproduce the views of the authoritative British Aeronautical Review on the vital matter of international cooperation of scientists and technical men working in aeronautics.

International Co-operation in Aeronautical Research

The appearance of a new German textbook on aerodynamics Handbuch der Flugzeugkunde, Vol. II "Aerodynamik" by Fuchs and Hopf, Published by Richard Carl Schmidt & Co. Berlin, and the publication of a series of articles in Aerial Age on "Standardization and Aerodynamics" draws attention to a subject which is of very considerable importance to the progress of knowledge in aeronautics. At the present moment there are aerodynamical laboratories of one sort or another in practically all civilized lands, and in those laboratories earnest seekers after knowledge are attempting to lay the foundations of an orderly knowledge of aerodynamics.

Obviously, unless all who are actively concerned with the science of aeronautics are fully informed of the results achieved by other workers in the same field there is likely to be a considerable waste of effort, and a correspondingly slower progress along the desired path. In the present stage of civilization difficulties due to difference of language as between various nations represent relatively little hindrance to the free exchange of ideas. Other and more artificial difficulties are in fact a much greater obstacle to the spread of knowledge than any difference of tongue.

These difficulties had their origin before the War, but the War has very considerably aggravated them.

Artificial Obstacles to Mutual Understanding

Among these obstacles are the absence of any internationally accepted system of units for aeronautical measurements, the lack of agreement as to a standard method of exhibiting the results of tests, and the serious discrepancies in the experimental results obtained by laboratories in different parts of the world.

These three difficulties are of importance to the practical engineer as well as to the scientist or research worker. A strange system of units is at best a nuisance, and at worst it may lead to serious errors. A polar diagram exhibiting the qualities of a particular wing section may convey nothing to one who is accustomed to the type of curve common in his country, and if he wishes to interpret it he must convert it to a more familiar form. And as he probably knows that the different wind channels of the world often disagree violently in their measurements on similar bodies he will very probably not trouble to convert it at all—simply because the results being of a different origin there is no certainty that they are accurately comparable.

Aerodynamical Units

The standardization of aerodynamical units presents no insuperable difficulty. Three systems of units are in use by the main aerodynamical laboratories of the world. The kilogramme-meter-second system introduced in France by M. Eiffel and standard in all Latin countries—the so-called "absolute" non-dimensional system adopted by the N. P. L.—and the German non-dimensional system. These three are connected by very simple numerical relations and any one of them would form a satisfactory working system.

The German system is possibly the most logical and the most convenient for scientific work, the British is little inferior, and would probably be more easily acceptable in certain quarters than would the German.

These seem to be very good reasons for standardizing the polar diagram as the method of expressing wing characteristics in a graphic form. This form of curve lends itself more directly to the construction of curves exhibiting the characteristics of a complete aeroplane than does the form more usual in Britain—but more important still is the fact that it is standard in every country except Britain and the United States—and it is very probable that it will shortly be adopted as a standard in the latter country.

Aerodynamical Units

Divergencies Between Wind Tunnels

The discrepancies between the results obtained by different wind tunnels are not so easily to be overcome. The N. P. L. some time ago arranged to construct a series of models, and to send these models on a tour of various aerodynamical laboratories, in order to obtain some evidence as to the extent of the concordance or otherwise between various wind tunnels. It is understood that the models are now on their travels, but unfortunately owing to political considerations all ex-enemy laboratories have been excluded from the programme.

(Which is obviously mere silly pandering to French prejudice. Ed.)

Also it would appear that certain of the authorities to which the models have been or are to be forwarded consider that the N. P. L. have devised the tests which it desires to be carried out without proper consultation with themselves, and there appears to be some risk that the tests will be even more restricted than was originally intended.

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Even so incomplete a series of tests will have a certain value and may help to clear up some of the present uncertainties, but very obviously the full advantage of any such an attempt to discover the real extent of divergence between the world's aerodynamical laboratories, and to account for and if possible remove the errors can only be gained if all the important laboratories—including those of Germany—take part in the tests in the right spirit.

The Need for Co-operation

This object could only be obtained as the result of co-operation between all the parties concerned. A very strong plea in favour of arranging for an interchange of views in order to arrive at an agreement both upon the standardization of unit and of symbols, and as to a programme of tests intended to clear up the question of the apparent differences between experimental results obtained at different laboratories has recently been made in America by Mr. W. Knight. A series of articles on the subject of standardization in aerodynamics written by Mr. Knight have appeared in "Aerial Age" of New York.

From these articles it appears that in general the aerodynamists of all countries are agreed in principle as to the desirability of such action. The main obstacles to any really international attempts to reach an agreement as to such action are of a political nature. The more important aerodynamical laboratories of the world are Government institutions. Certain Allied Governments would very certainly refuse to be represented even at a purely technical conference of this nature which was attended by German representatives. Under present conditions the American Government refuses to be officially represented at any international conference whatever—and such a conference unattended by a representative of the American Advisory Committee for Aeronautics would be of limited practical value. It seems that if once the Allies generally can be persuaded to admit German representatives to an international aerodynamic conference the difficulty as to American representation might be overcome.

It is certainly ridiculous to attempt to ignore Germany in this respect. In so far as the science of aerodynamics is concerned Germany at the present moment certainly leads the world and to attempt to boycott her representatives in such matters is merely to refuse to take full advantage of the advance in knowledge due to German effort.

It is probably useless to expect any action to the desired end to originate from France. Since the change in Government in Italy, that country can scarcely act.

Britain could and should take the initiative in this matter. The subject would need to be approached with considerable circumspection in order to avoid to the utmost extent the inevitable political outcry which would arise in certain quarters.

Fairly certainly some of our late allies would refuse to be represented at any conference which resulted. Equally certainly Germany and all the neutral States of any importance would accept, and if the difficulty of American representation could be overcome—as for instance by calling the American delegate an "observer"—the resulting agreement, if one were reached, would be of very much greater practical value than any result of a conference from which Germany was excluded.

Practical difficulties of a very serious nature stand in the way of the success of such a conference. It would be too much to expect the German representatives to refrain from laying stress on the hardships imposed on them by the clauses of the Treaty of Versailles which regulate Germany's aerial activities. On the other hand, however much their fellow delegates from other lands might sympathize with the hard lot of their German fellow workers it would be entirely improper, and probably disastrous, for a congress of this nature to allow itself to discuss such political questions as are involved in this matter.

Britain, America, and Germany, of all the nations who were involved in the late War, have the characteristics most likely to lead to an orderly discussion of the essentials of this question. And an agreement on the matters discussed above by those three nations would in time certainly be accepted by every aerodynamical scientist throughout the civilised world.

W. H. S.

Program for the National Aeronautic Association of the U. S. A.

Since the National Aeronautic Association of the U. S. A. has been formed, a new and a very important factor in aeronautics has been created.

The President of this Association, Howard E. Coffin, is one of the men who originally started to work along the line of standardization.

One of the purposes for which the National Aeronautic Association has been created is: "to promote the study for the advancement of aerial navigation of every nature, and to hold and conduct conferences and congresses for the purposes of such studies."

AERIAL AGE will welcome any authoritative aeronautical organization which will take the initiative in calling the international congress that we have been advocating during the last two years. We hope, however, that either the National Aeronautic Association of the U. S. A. or the National Advisory Committee for Aeronautics or both, will see the desirability from every point of view, of taking the lead in the movement which was started four years ago by William Knight, at that time, technical representative in Europe of the National Advisory Committee for Aeronautics.

(Concluded from page 123)

The Weather Bureau has co-operated also in many other enterprises, such as the recruiting trip of the NC-4; several trans-continental flights, including that from New York to Alaska; National and International Balloon Races; the recent trip of the C-2; etc., etc. In all cases this service has been keenly appreciated, as indicated by numerous statements of commendation, both written and oral. It has been apparent however, and, is clearly recognized by all concerned, that a similarly intensive service must be available, not merely along some particular route at some particular time, but *over practically the entire area of this country at all times.* Aviation is developing rapidly and will soon be a large factor commercially. It is essential, or rather it is vital, that meteorological service be developed and enlarged to meet the added demands that will be made upon it. Realizing this, the Weather Bureau has consistently sought added appropriations to make expansion possible. The lines along which development would proceed are set forth in appendix C of the report of the National Advisory Committee for Aeronautics, sent to the President on April 9, 1921, and transmitted by him to Congress on April 19, 1921. Briefly, the program contemplates the establishment of aerological observing and reporting stations at, or close to, all flying fields; also, at suitable intervals along all cross-country air routes. In addition there would be a large number of non-instrumental stations, from which reports of thunderstorms, squalls, fogs, poor visibility and other conditions inimical to flying would be received. The Weather Bureau is fortunate in being able to enlist the services of a large number of men who now act as co-operative observers and who could be engaged for this service at comparatively small cost and with little additional training.

Such in rough outline is the plan. Experience would, of course show where modification could appropriately be made, enlargement here—curtailment there. These are details. The all-important thing now is to get the general scheme started, and the one proposed makes a good beginning. Efforts to make possible this beginning through added appropriations have thus far been unavailable. It is earnestly hoped that such efforts will have their reward in the near future.

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Note on the Interpretation of Wind Tunnel Experimental Data with Reference to the Longitudinal Damping Characteristics of an Airplane

THE PRESENT note is concerned with the application of stability theory (as developed by Bryan, Bairstow, and others) to the data obtained by what may now be considered routine tests on the model airplane. In addition to the usual determination of lift, drag, and pitching moments on the complete model, it is now becoming the universal practise to remove the horizontal tail surfaces, and to determine the pitching moments for the model minus the tail-plane. Such a procedure yields a comparatively large amount of information.

Let the characteristics of the complete model be expressed in the standard forms:

$$C_L = \frac{L}{qS}\ ;\ C_D = \frac{D}{qS}\ ;\ \text{and}\ C_M = \frac{M}{q\,S\,c}$$

where L=lift, D=drag, M=pitching moment, q=dynamic pressure, S = wing area, and c = wing chord. The lift and drag coefficients C_L and C_D, and the moment coefficient C_M, for the complete model are, of course, non-dimensional. The dynamic pressure for standard conditions is $q = \frac{1}{2}\rho V^2 = .001185\ V^2$ with the velocity V in ft. per sec.

Stalling-moments are taken positive.

For present purposes we will take the moment coefficient for the machine minus the tail-plane as

$$C_{Mw} = \frac{Mw}{q\ S\ c}$$

and for the moment coefficient of the tail-plane about the center of gravity

$$C_{Mt} = \frac{Mt}{q\ S\ c}$$

In order to obtain exactly the effective moment due to the tail it is really necessary to test the remainder of the model in the *presence* of the tail-plane. This, however, usually presents some experimental difficulties if the work is to be done accurately, so, here, it will be assumed that, with sufficient approximation we can obtain

$$C_{Mt} = C_M - C_{Mw}$$

by simply taking moments with and without the tail-plane.

In the subsequent analysis we shall neglect slip-stream effect, due to the fact that the effect of the increase of velocity over the tail is to a very large extent neutralized by the change in the angle of downwash due to slip-stream. We will deal only with level flight conditions.

Choose a set of rectangular coordinate axes fixed in the airplane, with the origin at the center of gravity, and initially perpendicular and parallel to the flight path. When the airplane oscillates these axes move with it, and there will of course be components of the resultant velocity along these axes. It is important to note, however, that at the instant the motion begins the vertical, or z-axis, is parallel to the direction of lift and the x-axis parallel to the direction of drag. As regards signs: z and x are taken positive in the sense of the lift and drag, at the start of the motion. For a body having only three degrees of freedom, the equations of motion, with moving axes, take the forms

$$\frac{W}{g}\left(\frac{du}{dt} + wq\right) = X$$

$$\frac{W}{g}\left(\frac{dw}{dt} - uq\right) = Z$$

$$\frac{Wk^2}{g}\frac{dq}{dt} = M$$

where $u = \frac{dx}{dt}$ = velocity parallel to the x-axis, in the opposite sense to the velocity of translation.

$w = \frac{dz}{dt}$ = velocity component along z-axis.

$q = \frac{d\theta}{dt}$ = angular velocity in pitch (about lateral y-axis through the c. g.), when θ is the angle of pitch taken positive for stalling.

k = pitching radius of gyration.

M = pitching moment about lateral axis.

W = weight.

X = force component parallel to x-axis.

Z = force component parallel to z-axis.

t = time.

g = gravitational acceleration.

Now experimental results, based on stability theory, show that the variation of the velocity along the flight path is small, and that, for all practical purposes, when the oscillations are small, we can take u = — V when V is the mean forward velocity of the airplane. Lanchester, in his phugoid analysis (Aerodynamics), shows that the period of the long oscillation associated with the variation of forward velocity is given approximately by

$$t = 2\pi\frac{V}{g}$$

where t is the periodic time. Recent experiments by the N. A. C. A. have shown that, in actual flight, the period of the long oscillation depends only slightly on the pitching moment of inertia of the airplane. Furthermore, for nearly all airplanes this long period is a considerable fraction of a minute (or even longer). For which reasons enumerated we will neglect the variations in both X and V, the term wq being small. In this case the variation in the propeller thrust will also be negligible and the total pitching moment acting at any instant after the start of the oscillation will be

$$M = M_o + dM - h\ T$$

where T is the propeller thrust and h its moment arm, taken positive upward.

Now we note that

$$dM = \frac{\delta M}{\delta w}dw + \frac{\delta M}{\delta q}dq$$

but, since initially, $M_o = hT$, and $w_o = q_o = O$; then w = dw and q = dq. Therefore,

$$M = \frac{\delta M}{\delta w}w + \frac{\delta M}{\delta q}q$$

Similiarly, considering the equilibrium of the machine in the vertical direction, it is easily shown that

$$Z = \frac{\delta Z}{\delta w}w + \frac{\delta Z}{\delta q}q$$

We then obtain the equations

$$\frac{dw}{dt} + Vq = w\,Z_w + q\,Z_q \quad (1)$$

$$k^2\frac{dq}{dt} = w\,M_w + q\,M_q \quad (2)$$

in which Z_w, Z_q, M_w and M_q are the partial derivatives divided by the mass of the airplane; that is, for example, $Z_w = \frac{\delta Z}{\delta w}\frac{g}{W}$

Since we are dealing with small oscillations, and since the above partial derivatives are to be determined graphically from the experimental data, we will consider Z_w, Z_q, M_w,

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and M_q as constants, over the range of values of w and q with which we will have to deal. Our problem then becomes the very simple one of solving two linear differential equations with constant coefficients. Differentiate (2) with respect to t, eliminate $\frac{dw}{dt}$ from the resulting equation and (1), and then, finally, substitute the value of $q = \frac{d\theta}{dt}$; we obtain the linear third order equation,

$$\frac{d^3\theta}{dt^3} + a\frac{d^2\theta}{dt^2} + b\frac{d\theta}{dt} = O. \quad (3)$$

in which, for the sake of brevity, we have used the notation,

$$a = -\frac{M_q + k^2 Z_w}{k^2}$$

$$b = +\frac{M_q Z_w - M_w(Z_q - V)}{k^2}$$

A similiar equation, with identical coefficients, is, of course, obtained for w.

Writing (3) in the symbolic operational form, using D to denote differentiation with respect to t,

$$(D^3 + aD^2 + bD)\theta = O$$

the roots of D obviously being:

O,

$-\frac{1}{2}a - \sqrt{a^2/4 - b}$,

$-\frac{1}{2}a + \sqrt{a^2/4 - b}$,

the solution is obviously of the form (See Edwin B. Wilson "Advanced Calculus"):

$$\theta = e^{-\frac{at}{2}}\left\{C_1 e^{t\sqrt{a^2/4 - b}} + C_2 e^{-t\sqrt{a^2/4 - b}}\right\} + C_3$$

the three C's being the constants of integration. The motion is damped if a is positive, and undamped if negative. If a is zero and $b > O$, the motion is simple harmonic. There remain three possible cases of the radical expression to be considered, viz.,

(1) $b < a^2/4$
(2) $b = a^2/4$
(3) $b > a^2/4$.

In the first two cases the exponents are real and the motion non-oscillatory. In the third case the exponents are imaginary and the motion periodic. Reducing the terms in e to the trigonometric form, we find

$$\theta = e^{-\frac{ta}{2}}\left\{A \sin t\sqrt{b - a^2/4} + B \cos t\sqrt{b - a^2/4}\right\} + C$$

where A, B, and C need not be specifically determined here. The period of the oscillation is

$$T = \frac{2\pi}{\sqrt{b - a^2/4}} \quad (4)$$

The logarithmic decrement, defined as the ratio of amplitudes at intervals of time equal to the period T, can easily be verified by the reader to be given by

$$\log\frac{\theta_0}{\theta_1} = \text{const.} = \frac{aT}{2} \quad (5)$$

We will concern ourselves with the development of a satisfactory criterion for the development of damped periodic motion of the airplane. While it is true that, as shown, the motion may be damped (stable), but non-oscillatory, such a condition would likely be associated with too large pitching moment of inertia, and poor manœuverability. Professor Edward P. Warner (Massachusetts Institute of Technology) has suggested as a stability criterion the ratio of the time to damp to half amplitude of the period. If it is the time required to reach a given amplitude θ, the reader can easily verify that

$$\log\frac{\theta_0}{\theta} = \frac{at}{2}$$

and hence for $\frac{\theta_0}{\theta} = 2$

$$t = \frac{1.386}{a}$$

Designate the stability coefficient by C_s and we have

$$C_s = \frac{t}{T} = \frac{1.386\sqrt{b - a^2/4}}{2\pi a}$$

Or simply

$$C_s = \frac{0.221\sqrt{b - a^2/4}}{a} \quad (6)$$

The condition of damped periodic motion, $b > a^2/4$ simplifies to

$$M_w < \frac{(M_q - k^2 Z_w)^2}{4(Z_q - V)k^2} \quad (7)$$

It is to be noted that, for $Z_q = O$, the above criterion becomes idêntical, in form, to that given by Dr. Max Munk in N. A. C. A. Report No. 133 under the title "The Tail-Plane."

Determination of Resistance Derivatives.

I. To obtain M_w note that

$$\delta M = \frac{\delta M}{\delta \alpha}\delta\alpha$$

where α is the wing angle of attack to which the pitching moment curve for the machine is referred. But approximately $\alpha = 57.3\frac{w}{V}$; then

$$\frac{\delta M}{\delta w} = -\frac{57.3}{V}\left(\frac{\delta M}{\delta\alpha}\right)$$

and hence

$$M_w = -\frac{57.3 g}{VW}\left(\frac{\delta M}{\delta\alpha}\right)$$

Here $\frac{\delta M}{\delta\alpha}$ is the slope of the pitching moment curve for the full size machine at the given velocity, V. As model tests show that, at a given angle of attack the slope of the moment curve is nearly independent of elevator (or stabilizer) setting, we can write

$$M_w = -\frac{57.3 g}{VW}qSc\left(\frac{dC_M}{d\alpha}\right)$$

But since $W = C_L qS$, then

$$M_w = -\frac{57.3 g c}{V C_L}\left(\frac{dC_M}{d\alpha}\right)$$

II. To obtain Z_w note that with moving axes,

$$Z_o + dZ = (L_o + dL)\cos d\alpha + (D_o + dD)\sin d\alpha$$

Placing $\cos d\alpha$ equal to unity and $\sin d\alpha = \left(\frac{d\alpha}{57.3}\right)$ and noting that under initial conditions, $L_o = Z_o$ we obtain

$$\frac{dZ}{d\alpha} = \frac{dL}{d\alpha} + \left(D_o/57.3\right)$$

But, again, since $W = C_L qS$, and $\alpha = -57.3\, w/V$, we have

$$Z_w = -\frac{g}{C_L V}\left(57.3\frac{dC_L}{d\alpha} + C_D\right) \quad (9)$$

III. Determination of M_q:

The damping in pitch is due largely to the action of the tail surfaces. Experiments seem to indicate that for ordinary tractor machines from .8 to .9 of the total value of M_q is contributed by the tail-plane. Let us denote by f the ratio of the tail M_q to the value of M_q for the entire machine. The effective moment of the tail-plane (M_t) is found by determining both the moments with and without the

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tail-plane and then computing the coefficients; thus

$$C_{Mt}=C_M-C_{Mw}$$

If α_t is the mean effective angle of attack of the tail and ϵ the mean downwash angle, then

$$d\alpha_t = d\alpha - d\epsilon$$

Therefore

$$\frac{dM_t}{d\alpha_t} = \frac{1}{\left(1-\frac{d\epsilon}{d\alpha}\right)}\left(\frac{dM_t}{d\alpha}\right)$$

During the oscillation we have approximately

$$\alpha_t = 57.3\frac{rq}{V}$$

where r is the effective lever arm of the tail-plane (center of pressure assumed constant at 33% of mean chord.) Then

$$\frac{\delta M_t}{\delta\alpha_t} = \frac{V}{57.3\,r}\left(\frac{\delta M_t}{\delta q}\right)$$

Next, noting that $M_t=C_{M_t}qSc$, and making the substitutions indicated above, we obtain

$$M_q=\frac{57.3\ r\ g\ c}{C_L V\left(1-\frac{d\epsilon}{d\alpha}\right)f}\left(\frac{dC_{M_t}}{d\alpha}\right) \quad (10)$$

IV. There is some uncertainty about the determination of Z_q, which. however, is comparatively so small that it is usually neglected in approximate calculations. The change of Z with angular velocity in pitch is due to both wings and tail-plane; but principally to the latter. It is probable that the British obtain a fair estimate by assuming that

$$Z_q = \frac{f\ M_q}{r} \quad (11)$$

From (10) and (11), then, we find

$$Z_q=\frac{57.3\ g\ c}{C_L V\left(1-\frac{d\epsilon}{d\alpha}\right)}\left(\frac{dC_{M_t}}{d\alpha}\right) \quad (12)$$

The downwash may be easily determined by exploration with the tail-plane; but, again, unless the tail-plane is greatly shielded or portions of the wings are cut away in the vicinity of the body, one can use, with good accuracy, the familiar approximation $\frac{d\epsilon}{d\alpha} = \frac{1}{2}$. In regard to M_q, formula (10) should give a good estimate, except in rare cases in which the tail-plane is very small, or greatly shielded by a large fuselage. In such exceptional cases the oscillator should be used.

In conclusion: It should be noted that, in computing the coefficients M_q, Z_w, etc., by formulas (8) to (11) care must be exercised in substituting the derivatives. taken from the characteristics of the machine, with their appropriate signs. The sign of V only need not be considered as. at the outset, we substituted (—V) for u in the equations of motion.

Wright Patent Expires This Year

THE WRIGHT patent expires May 22, 1923, after 17 years of an up-and-down career, with the brothers Wright battling for their reward for almost a decade. It seems but yesterday when we were trying to tell the world the Wrights had flown, yet a score of years will soon have passed since Kill Devilians saw the birth of a new transportation, a transportation even now in its American swaddling clothes.

On May 23, the airplane manufacturing field will be free to all comers, American and foreign, save, perhaps for the Montgomery patent, which, however, expires September 18, 1923, though this still remains to be adjudicated. (No. 831,173, issued Sept. 18, 1906).

Its adjudication is now a possibility. Both sides in the litigation now pending in the Court of Claims between the heirs of Prof. J. J. Montgomery and the Government for payment of royalties on war-built airplanes, have completed testimony-taking.

If the Montgomery patent, by any chance, is held valid, and the Federal court's opinion overthrown as to the value of the patent in the Wright-Curtiss suit, the Government may pay a royalty fee on the 13,894 airplanes built or purchased during the war, and on those bought subsequently as well. The manufacturers may then be called on in another suit to pay royalty on all other machines constructed since. The Montgomery claims total 45, beginning with one covering "a curved wing with means for changing its curvature," followed by others in modification.

Montgomery's Glides of 1905 Beat Hentzen's of 1922

Hentzen's glides are overshadowed by the acrobatic feats of Maloney, Wilkie and Dofolco, daredevil airplane riders of 1905, employed by Montgomery in testing and subsequently in a series of exhibitions in a number of California cities.

"On one occasion, Maloney in trying to make a very short turn during rapid flight pressed very hard on the stirrup which gives a screw shape to the wings and made a side somersault," wrote Montgomery in 1909 to the author of this article.

"The course of the machine was very much like one turn of a corkscrew. After this movement, the machine continued on its regular course. And afterwards Wilkie, not to be outdone by Maloney, told his friends he would do the same, and in a subsequent flight, made two side somersaults, one in one direction and the other in an opposite, (witnessed by thousands of people), then made a deep dive and a long glide, and when about three hundred feet in the air, brought the airplane to a sudden stop and settled to the earth. After these antics, I decreased the extent of the possible change in the form of wing surface so as to allow only straight sailing or only long curves in turning."

During his work Montgomery offered to cover a thousand dollars to send the airplane up upside down and if the machine did not immediately right itself. make a flight and come safely to the ground, with a sack of sand in the rider's seat, the money would go to the opposite side. The bet was never taken.

On April 29, 1905, from the college grounds at Santa Clara, Calif., Montgomery sent up an ordinary hot-air balloon, to which was attached a 45-pound glider, with Daniel Maloney, an old-time parachute jumper, in the seat.

At a height of about 4000 feet the airplane was cut loose from the balloon and commenced to glide to the ground. "In the course of the descent the most extraordinary and complex maneuvers were accomplished—spiral and circling turns being executed with an ease and grace almost beyond description, level travel being accomplished with the wind and against it, figure eight evolutions performed without difficulty, and hair-raising dives were terminated by the abrupt checking of the movement by

(*Concluded on page* 142)

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The Bristol Three-Seater Airplane

The Bristol 3-Seater Airplane

A Taxiplane Designed to Compete Economically with Road Transport

General Description

The "Bristol" 3-seater Airplane is a single-engined Tractor Biplane, designed to carry two passengers, in addition to pilot, with a considerable amount of baggage. The whole construction of machine and power unit installation has been considered from the standpoint of the owner-pilot, and calls for the minimum quantity of spare parts.


The Motor Installation of the Bristol Three-Seater

Engine Installation

The "Bristol" Lucifer engine is mounted on a readily removable swinging mounting, which gives instant access to the back of the engine for adjustment of magnetos and carbureters and dispenses with the necessity for removable cowling.

A steel fireproof bulkhead is fitted behind the engine, and all control connections pass through fireproof glands.

Carbureter intakes are carried through the bottom side of the engine cowling, eliminating any possibility of petrol accumulating.

Pilot's Cockpit

The pilot's cockpit is immediately behind the engine, and is fitted with controls of the stick and rudder bar type. The view for landing is extremely good.

Passengers' Cockpit

The passengers' cockpit is immediately behind that of the pilot, and seats the two passengers side-by-side on a comfortably upholstered seat, entrance being by means of a door in the side of the fuselage. A detachable top, converting the cockpit into an enclosed cabin, can be supplied.

Baggage Hatch

The baggage hatch is immediately behind the passengers and can accommodate two large suit cases.

Gasoline System

The gasoline system is pure gravity from a scuttle tank in front of the pilot. A large readily demountable filter is fitted.

Wings

The upper and lower wings are identical and interchangeable. They are of the single bay type and the in-

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terplane struts are of "N" formation, requiring no trueing up.

Chassis

The Chassis is of the oleo-elastic type. Elastic rings are used for suspension and can he readily changed. The oleo plungers are fitted with a special type of tapered needle valve to control the passage of the oil through the plunger, to give constant oil pressure throughout the stroke of six inches.

Flying Controls

As mentioned, the controls are of the stick and rudder bar type; all cable pulleys, wherever used, are five inches diameter.

Tail Trimming Gear

The tail incidence can be varied by a lever and quadrant adjacent to the pilot to trim the machine under all conditions of speed and load distribution.

Specification

Dimensions	
Span	31′ 0″
Length overall	23′ 3″
Height	8′ 10″
Weights	lbs.
Machine empty	1.210
25 gals. Petrol	
3 gals. Oil	
Fuel and Oil	215
Pilot	180
Passengers (2)	320
Baggage	75
	2,000

Loading	
Weight / H.P. ("Bristol" Lucifer at 100 h.p.)	20.0
Weight / sq. ft.	7.0
Performances	
SPEED	
At ground level fully loaded	90 m.p.h.
At ground level less passengers and baggage	93 m.p.h.
At 5,000 ft. fully loaded	88 m.p.h.
At 5,000 ft. less passengers and baggage	91 m.p.h.
CLIMB	
To 1,000 ft. fully loaded	2 minutes.

Mechanical Device For Illustrating Airplane Stability

AN instrument for the lecture room which illustrates completely in a qualitative sense nearly every property of a flying airplane with astonishing exactness, allows mathematicians to visualize the actual behavior of an airplane without having to make flights and holds the possibility of mechanically solving stability equations, has been built by the technical staff of the National Advisory Committee for Aeronautics.

This instrument is remarkably simple. It is easy to construct a piece of apparatus which will show dynamic stability or damped oscillations—for example, a pendulum. But a simple device which could be altered to give any degree of stable or unstable motion was long desired. So far as known, this new instrument is the only simple method for accomplishing this.

At first it was expected that only the degree of damping of an oscillation would be illustrated, but as the instrument was more carefully studied it became evident that every property, practically, of an airplane in flight was represented accurately, and this was confirmed by the fact that equations of motion worked out in almost identical form with those of Bryan and Bairstow for the airplane.

The instrument consists essentially of a double pendulum, the lower end of which is a wheel resting on a revolving drum. The drum can be turned at any speed by an electric motor, and the stability and moment of inertia about the two pendulum axes can be varied at will.

The properties of an airplane are represented in the following way:

1. The restoring moment about axis A is the pitching moment about the c. g. of the airplane and represents a static stability or metacentric height.
2. The restoring moment about axis B is the damping of the airplane —Mq.
3. The moment of inertia about A represents the mass of the airplane.
4. The moment of inertia about B represents the moment of inertia of the airplane about the Y axis.
5. The angular motion about A represents changes in airspeed along the path—V.
6. The motion about B represents changes in inclination of the machine in respect to the horizon.
7. The angular movement of the wheel in relation to the drum axis represents the inclination of the path with the horizon.

Just why the above representation is true can not be explained at present, hut from actual trial this instrument does behave in this manner. The speed of rotation of the drum has some influence on the characteristics of the motion, but just what this effect is has not yet been determined.

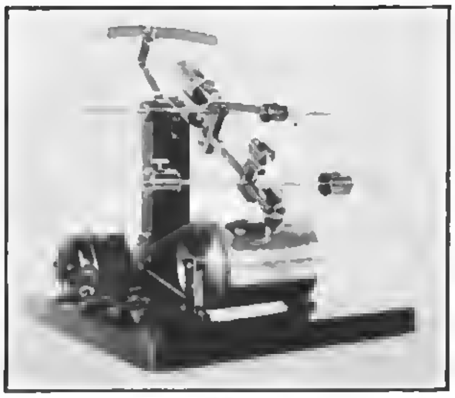

Fig. 1

By adjusting the upper balance weight, any degree of static stability may be obtained and the change from an oscillation to a divergence is clearly illustrated. The oscillation is more stable (greater damping) when either the mass of the airplane (upper lateral weights) is increased or the moment of inertia (lower lateral weights) are decreased as indicated by theory.* The damping is also varied by changing the moment about the lower axis.

An oscillation can be produced which is stable below a certain magnitude and unstable above it. It is also possible to produce an oscillation which will damp down to a finite value and remain there permanently. This is particularly interesting as the same phenomenon has been observed in actual flight.

This particular design of instrument has the disadvantage that the moment of inertia about each axis is changed at the same time as the restoring moment so that the two effects are combined. This can easily be remedied by the use of springs instead of weights, and will be so changed in another instrument.

Theory of the Instrument. Instrumental records taken in flight of the air speed and path angle during an oscillation of constant amplitude show that these variables are, as

*Thomson, "Applied Aerodynamics" —p. 208.

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closely as can be determined, sine functions of the time, but are of course at a small phase difference. The path of the airplane in space can not be a sine curve, but in stability calculations the amplitude has been assumed so small that the departure from it is negligible. By assuming small oscillations, angles may be used in place of sines of angles and the usual theory of Bryon and Bairstow can be applied. Working in the same way, W. P. Angel has carried out an analysis of this instrument which gives equations of the same form as for the airplane. In both cases however the oscillations are assumed small and so can not apply strictly to the actual conditions. It is felt that

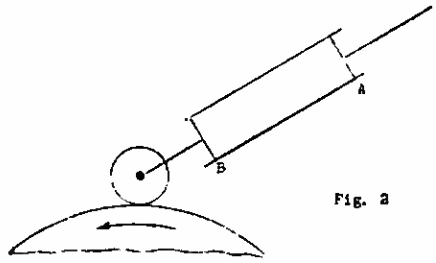

Fig. 2

if an exact solution can be made of the motion of this instrument, we shall have at the same time the exact solution of the airplane motion. It is hoped that mathematicians will interest themselves in this problem.

Uses This instrument is useful for making visible the very complex behavior of the airplane during an oscillation. In several instances new facts were observed on the instrument and later checked in flight. It can also be used for illustrating in the classroom or lecture hall the effect on stability of making changes in the various characteristics of the airplane.

It is hoped that this instrument may be used quantitatively to determine the type of oscillation for a new airplane, by setting the characteristics (mass, moment of inertia, damping, etc.) of this airplane on the graduated scales of the instrument. Whether this can be done or not is difficult to predict, but experiments along this line will be carried out.

(Continued from page 139)
changing the angle of the wing surfaces."

Montgomery began his work in 1883 with a flapping wing machine. In the following two years he constructed models which were tested by dropping them from a cable suspended between two mountain tops. Then a large machine was built with which a number of glides were made. There experiments continued until 1894, and resumed in 1903, ending in the fatal accident to Maloney, in 1905. In this flight, as the balloon was rising with the airplane, a guy rope dropping switched around the right wing and broke the tower that braced the two rear wings and which gave control over the air. Whether Maloney knew of the accident or not, is not known. At about 2000 feet Maloney cut loose, the rear wings began to flap, the machine turned on its back and settled a little faster than a parachute. When Maloney was reached he was unconscious and lived but thirty minutes. The only mark of any kind on him was a scratch from a wire on the side of his neck. The six attending physicians were puzzled as to the cause of his death.

L. W. F. to Market the Eagle-Asp "Ant"

Without waiting for the second coming, or the Winslow Bill or a milky way of aerodromes, the L. W. F. company has up and bought the little "Ant" of Captain Eagle and Lieutenant Asp. When all the "bugs" are worked out and it is turned into a production job, somebody may buy one, if the company isn't careful. An army officer says "the day is going by when traveling by air should necessarily be more expensive than traveling by automobile," and the "Ant" seems to be an example of development along the right line. A machine of this type should sell at a reasonable price and should be manufactured so cheaply that the complete outfit can be placed on the market for $2000, or even less. There would seem to be a possible market for a foolproof, low-priced, efficient, practical airplane that can get up and get down in a comparatively small space.

In the Southern Aerial Derby, last August, Lieutenant Asp won by a wide margin over an SE-5 and a Spad 220, at a speed of approximately 130 miles an hour for 50 miles. This little machine, with a 60 h.p. Lawrance, in a test at Ellington Field, flew 125 miles on 5 gallons of gasoline and it is expected that with a 40 horse engine in a plane like this it can fly close to 100 miles an hour for four hours on 10 gallons of fuel. And, there are no unusual features contributing to the success of the machine, other than extreme lightness and strength of the truss members and the gap of 1½ times the chord.

Eagle and Asp designed the machine without the aid of McCook Field, it is currently reported. Strange as it may seem, look at the darn thing. It's got gaps and stagger 'n everythin'.

The span of the upper wing, which is in one section, is but 18 ft., while the lower, also in one section, spans 14 ft. The chord is 3½ ft. and the gap 5¼ ft. The main support of the two wings are two solid struts running diagonally across each other from the top wing to the lower one, both passing straight through the fuselage, giving them the appearance of a huge "X." The plane is then trussed up at each end of the wings by two x-struts, with a small truss running to the axle. Strength is there. Pancaked from 75 ft., the shock was absorbed in all parts of the wings and nothing was damaged but the landing gear. The stagger of the wings can be changed 4½ inches by loosening four bolts at the bottom of the fuselage. The combined landing gear and struts from the fuselage to the upper wing are in one piece.

The wings have a flexible trailing edge. The engine is the same 60 h.p. Lawrance installed in the "Messenger" and with an ordinary air screw the machine takes off in less than 50 ft. and attains an altitude of 1000 ft. in 30 seconds. The landing speed is about 30 miles. Upon alighting, both ailerons can be pulled down for use as a brake without affecting their normal operation.

Technical Notes of the N. A. C. A.

Since the publication of the list of "Technical Notes" of the National in the January number of Aerial Age, Advisory Committee for Aeronautics there have been prepared by the Committee the following:

111. Stresses Produced on an Airship Flying through Gusty Air. By Max M. Munk, N. A. C. A.
112. The N. A. C. A. Three Component Accelerator. By H. J. E. Reid, N. A. C. A.
113. Report on General Design of Commercial Aircraft. By Edward P. Warner.
114. Supplementary Report on Oilscraper Piston Rings. By H. S. McDewell.

See December number, page 610, for note on the publication of list of all Government publications on aeronautics.

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Offices of Aeronautic Intelligence

By William Knight

THE eighth annual administrative report of the National Advisory Committee for Aeronautics which has been recently submitted to the Congress is a document deserving the most careful consideration by that legislative body and should bring about the most generous response from the Bureau of Budget.

The National Advisory Committee for Aeronautics was established by act of Congress, approved March 3, 1915. The organic act charges the committee with "the supervision and direction of the scientific study of the problems of flight with a view to their practical solution, the determination of problems which should be experimentally attacked, their investigation and application to practical questions of aeronautics.

The work of the National Advisory Committee for Aeronautics (N. A. C. A.) is carried through by a number of committees and sub-committees in charge of some particular branch of aeronautical activities. One of these committees is the committee on publications and intelligence whose functions are:—

1—The collection, classification, and diffusion of technical knowledge on the subject of aeronautics to the Military and Naval Air Services, and civil agencies interested, including, especially, the results of research and experimental work done in all parts of the world.

2—The encouragement of the study of the subject of aeronautics in institutions of learning.

3—Supervision of the Office of Aeronautic Intelligence.

4—Supervision of the committee's foreign office in Paris.

5—The collection and preparation for publication of the technical reports, technical notes, and annual report of the committee.

The office of Aeronautical Intelligence of the N. A. C. A. was established in the early part of 1918 as an integral branch of the Committee's activities. It is the officially designated Government depository for scientific and technical reports and data on aeronautics.

Establishment of the Paris Office of the N.A.C.A.

The extension of the activities of the Office of Aeronautical Intelligence abroad to cover technical progress made in Aeronautics in Europe was decided upon on May 1919 following a number of suggestions to that effect contained in a report of mine to the Chief of the Air Service which were adopted by the N. A. C. A.

In May 1919 I was appointed Technical Assistant in Europe to the National Advisory Committee for Aeronautics for the purpose of:—

(a) "to establish and to promote a prompt and cordial exchange of scientific and technical data and information on research and experimental work in aeronautics and sciences thereto allied between the United States on the one hand and the Governments, private institutions and individuals of France, England, Italy, Belgium, Switzerland, Holland and Germany on the other hand."

(b) "to act as the officially accredited representative of the National Advisory Committee for Aeronautics in Europe in all relations with Government officials, private institutions and individuals in the countries named above."

On June 1919 I established the Paris office of the N. A. C. A. and from that date to June 1921, while I was in charge of the activities of the N. A. C. A. in Europe, 50% of the total number of documents communicated to the committee by all sources of information, were obtained in Europe by and through its Paris office. The total expenses involved in the establishment and maintenance of that office for the same period of time was 20,000 dollars, or, 5% of the appropriation of the N. A. C. A. for the fiscal years 1920 and 1921.

Work Done by Our Scientific Attaches During the War

When I suggested right after the war the establishment of a post-war organization for the purpose of continuing, at least in aeronautics, the work of Scientific co-operation between the United States and the allied nations in Europe which had been inaugurated during the war and which had been carried through the offices of Scientific Attaches to the American Embassies in London, Paris and Rome, I was prompted by the fact that the very first offices which were abolished immediately after the armistice were the offices of our Scientific Attaches abroad.

The work done by our Scientific Attaches abroad during the war is not generally known. Scientific work, in general, never gets (and as a matter of fact never expects) the honors which are rightfully paid to military operations in the process of winning a war. Scientific and technical work, however, had their share of responsibility in making possible our winning the war, and the offices of our scientific attaches to the American Embassies in England, France and Italy did their share of work while they lasted.

The best and the most important part of the work done by our Scientific Attaches abroad during the war, in my estimation, was the establishment of a fine spirit of co-operation between European and American Scientists and technical men. As far as I know, we were the first nation which during the war created the office of the Scientific Attache. Up to that time, military, naval and commercial attaches only, constituted the official diplomatic family of Ambassadors. The war conferred upon our Scientific attaches the honor of representing abroad the contribution of American scientists and technical men to the job of winning the war.

As I said before, however, this honor was short lived and with the advent of peace it was not felt any longer the need of diplomatic scientific representation abroad, this need being limited to-day, as it was before the war, to the representation abroad of our military, naval and commercial interests.

Why the Paris Office of the N. A. C. A. was Established

When I went to Europe on June, 1919 for the purpose of carrying out the instructions specified above, our National Advisory Committee for Aeronautics was practically unknown there. At the present time, however, due to the important scientific research work done by this committee, and due to the great usefulness of its technical reports which are very generously distributed to people and organizations interested in aeronautics both in this country and abroad, (32,166 copies of these reports were distributed during the past year) our National Advisory Committee for Aeronautics is one of the most important aeronautical scientific organizations in the world.

My conception of co-operation between American and European scientists and technical men in advancing the knowledge of aeronautics through the promotion of a cordial exchange of scientific and technical data and thoughts, which had prompted me to suggest and which had led to the establishment of a foreign office of Aeronautic Intelligence of the N. A. C. A., was not always consistent with the limited functions which for a number of reasons had to be assigned by the N. A. C. A. to its Paris office.

After almost four years of efforts for bringing about, at least in aeronautics, a true spirit of international responsibility in the progress of science and a human feeling of personal responsibility among scientists and technical men of all nationalities in bringing about the desired results through co-operation, I feel more than ever that my point of view of what should have been the functions of the Aeronautic Intelligence Service of the N. A. C. A. was and is correct.

At the present time the functions of the Paris office of the N. A. C. A. are so defined in the eighth annual report of the committee:—

"To efficiently handle the work of securing and exchanging reports in foreign countries, the committee maintains a technical assistant in Europe, with headquarters in Paris. It is his duty to personally visit the Government and private laboratories, centers of aeronautical information, and private individuals in England, France, Italy, Germany, and Austria, and endeavor to secure for America not only printed matter which would in the ordinary course of events become available in this country, but more especially to secure advance information as to work in progress, and any technical data not prepared in printed form, and which would otherwise not reach this country."

Establishment of the Offices of Assistant Military and Naval Attaches in Charge of Aeronautics

The offices of Aeronautical Intelligence of the Army and Navy also maintain representatives of their own in Europe, officers of the Military and Naval air services, respectively, attached to the Staff of Military and Naval Attaches for the same purpose of obtaining reports and information on aeronautics in foreign countries.

The representative of the committee abroad is supposed to look after information of a technical nature only and is now supposed to apply for such information through the offices of Military and Naval Attaches whenever the source of information is under governmental control. When the Paris office of the N. A. C. A. was established in 1919 the Air service of the War and Navy Departments had no representatives of their own attached to the staff of Military and Naval Attaches and the representative of the N. A. C. A. abroad was directly in touch with Governmental Aeronautical Services and was officially accredited through our Ambassadors abroad to the various Air Ministries in Europe and through these to the various technical services under their control—likewise introduction to educational institutions not under the control of the War and Navy Departments were obtained through the Ministries of public education upon request of our Ambassadors.

Quite evidently this procedure immediately placed the European representative of the N. A. C. A. on such official status as to enable him to obtain for the Committee and for the War and Navy Departments any desired information on aero-

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nautics which would have been proper for us to ask.

The program of cordial co-operation with European scientists and technical men adopted by the Committee was most sympathetically endorsed by Government officials and private individuals in Europe, and it is due to their fine spirit of co-operation in the development of such a program that I was able to transmit to the Committee in Washington during the two years that I was in charge of the Paris office of the N. A. C. A. 3,200 reports (most of them of a very confidential nature) and advance information about scientific research work either in progress or being planned for.

Government Officials and Private Individuals In Europe Eager to Co-operate with the N. A. C. A.

The work started by the N. A. C. A. in Europe, through its Paris office was looked upon as a continuation on a limited scale of the work done during the war by Scientific Attaches and the fact that the N. A. C. A. was a civilian organization not under the control of either the Navy or the War Departments, acting as a technical consulting committee responsible to the President of the United States and to Congress only, contributed a good deal to the establishment of cordial relations with European scientist and technical men who, in general, are not particularly keen about giving information to Army and Naval officers attached to the staff of Military and Naval Attaches.

For the same reasons aircraft manufacturers and inventors who would have not been willing to give information to our War and Navy departments which would have eventually reached our own aircraft manufacturers, their competitors, were quite willing to give information to the National Advisory Committee for Aeronautics upon the assurance on my part that information thus obtained would only be used by the Committee for technical research work, would not be divulged if so desired and that the Committee was ready to reciprocate the courtesy by exchanging information and technical data with them.

It is not surprising if under so many favorable conditions the establishment of the Paris office of the N. A. C. A. was a very successful undertaking—especially so if we consider that the office personnel that I engaged in Paris made up a most competent staff for our work which required technical knowledge of aeronautics and knowledge of languages. In fact we had as aerodynamical expert of our Paris office Mr. W. Margoulis, a former Director of the Eiffel Laboratory, and the combined knowledge of languages of our technical translators included: English, French, Italian, German, Spanish, Portuguese, Hungarian, Russian and Polish.

It is not surprising either that when later on military and naval officers, representing the Air Services of the War and Navy Departments respectively, were sent abroad as assistant military and naval attaches in charge of aeronautics, the Paris office of the N. A. C. A. was better equipped to obtain aeronautical information from both governmental and private sources of information than it was possible for them to do.

Monthly Technical Meetings at the Paris Office of the N.A.C.A.

In order to promote the spirit of co-operation between European and American scientists and technical men interested in aeronautics that I had been sent abroad for, we organized monthly meetings held in Paris for the purpose of discussing technical aeronautical problems of general interest. The importance of these meetings is proved by the attendance to them of Prof. Toussaint, director of the St. Cyr Aerodynamical Institute; Prof. Marchis of the University of Paris: Prof. Allard, technical director of the Belgium Air Service; Mr. Devillers, chief engineer of the Breguet works and formerly director of the Bureau of Standards S. T. Aé.; Dr. Garsaux, chief of the Physiological Department of the St. T. Aé,; Dr. Deschieu, technical advisor to the French Military Section of Aviation; Dr. Laprelle, Director of the Eiffel Laboratory; Mr. Gourdon and Mr. Leseurre, Directors of the Gourdon-Lesenrre Works; Mr. Letang, Director of the Aviation Department of the Schneider Works; Mr. Vienart, metallurgical engineer of the Schneider works; Capt. Griman, of the Experimental Division S. T. Aé; Capt. Lamé of the Motor Division S. T. Aé.; Capt. Huguet of the Airplane Division of S. T. Aé; and others.

At each meeting a paper was presented by one of the members and a very interesting discussion would follow. We had papers on wind tunnel design, on wind tunnel experimental work, on helicopters, on turbo-compressors, etc. A copy of the papers presented at our meetings and a resumé of the discussion was sent to the N. A. C. A. after each meeting.

These monthly meetings offered the unusual opportunity to the N. A. C. A. of being able to obtain the advice of the most distinguished aeronautical experts in Europe on any desired subject and in my estimation, it would have been very desirable, indeed, to organize in Paris subcommittees on aerodynamics, power plants for aircraft, and materials for aircraft, working in connection with similar subcommittees in Washington. I repeatedly made this suggestion to the N. A. C. A. which, however, for a number of reasons, has always been unable to take any action in this direction. As a matter of fact, these meetings could not even be held under the auspices of the N. A. C. A. They were held under the auspices of both Mr. Margoulis and myself but nevertheless were greatly appreciated by everybody concerned with them.

The Technical Review of Aeronautics Issued by the Paris Office of the N.A.C.A.

Considering the fact that most of the aeronautical reports originated in Europe were not written in the English language and could not be all translated by our office force in Paris, technical works appearing in new books, magazines, reports of engineering societies, unpublished reports of research laboratories, patents about new inventions, opinions, comments, suggestions and criticisms by eminent European aeronautical experts, designers and technical men on aeronautical problems were presented to the Committee in a monthly report issued by the Paris office of the N. A. C. A. under the title: "Review of Aeronautical Works".

Mr. W. Margoulis was in charge of the preparation of that review and it is due, both to him and the exceptionally good technical translators that we had, *all* the credit for the good work that we accomplished with that review. Also it was due to gratuitous and very kind collaboration of such men as Prof. Prandtl, Prof. Toussaint, Dr. Riabouchinski, Devillers, Rohbach and others if we were able to issue a review which has been highly complimented upon by competent judges of such a work both in this country and in Europe. Twelve numbers of this review were issued (some of the material contained in that review has since been published in book form by Mr. Margoulis) before we had to discontinue this work, due to the fact that we had to dispense with the services of Mr. Margoulis because he was not an American and the Committee, while it recognized that his services as aerodynamical expert of the Paris office were extremely valuable, "had to be careful in avoiding being criticized for employing foreigners instead of Americans". Also it seems that, for some reason or other, all technical work by the committee had to be originated in Washington and not elsewhere.

Duplication of the Efforts—Usefulness of the Paris Office of the N.A.C.A. Curtailed—

When assistant military and naval attaches in charge of aeronautics were sent abroad for the purpose of obtaining data and information on aeronautical developments for the offices of aeronautical intelligence of the War and Navy Departments, respectively, it was inevitable that their work should overlap and encroach upon the work done by the Paris office of the N. A. C. A. This state of affairs inevitably led to a duplication of efforts on the part of three agencies of the same Government independent one from another, all looking for the same sort of information. This situation soon became very annoying to all concerned and especially to foreign officials who were requested by three separate representatives of our Air Services (without counting the numerous representatives of one branch or another of our Government that are occasionally sent abroad on all sorts of missions requiring the investigation of matter already investigated by the N. A. C. A. and by military and naval attaches) to furnish over and over again the same information and the same reports.

In order to correct this situation something had to be done and the logical thing to do would have been to make some sort of arrangment whereby all aeronautical information of a technical nature should have been forwarded by aeronautical and military attaches to the Paris office of the N. A. C. A., and by this office to the committee in Washington and all requests for technical data and information on aeronautical developments in Europe as requested by the War, the Navy and any other department interested in aeronautics should have been forwarded to the Paris office of the N. A. C. A. If for some reason or other this could not have been accomplished, the next best thing to do would have been either to abolish the Paris office of the N. A. C. A. and let aeronautical and military attaches take care of both the military and technical end of the work, or else to place the Technical Assistant in Europe to the N. A. C. A. under the orders of Military and Naval attaches and let the Paris office of the N. A. C. A. be some sort of a subsidiary office helping them in all matters requiring the services of a technical staff which they do not have.

What was actually decided to do was this:—all requests of information desired by the N. A. C. A. had to be communicated by the European representative of the Committee to Military and Naval attaches and the desired information had to be applied for and had to be obtained through them whenever the source of information was under Government control. In other words Military and Naval attaches, or their assistants in charge of aeronautical matter, were supposed to hunt up information and reports for the Paris office of the N. A. C. A. (which, however, they never did while I was in charge of

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that office). All personal contacts between the representative of the N. A. C. A. and Government officials or aeronautical Governmental services had to be established through the offices of Military and Naval attaches which would make arrangements for the desired interviews.

Such an arrangement which finally superseded the previous arrangement whereby the European representative of the N. A. C. A. had been formally accredited to various European Governments by our Ambassadors as "a Government official representing the National Advisory Committee for Aeronautics, a technical Governmental Organization reporting directly to the Congress and to the President of the United States", changed quite some the standing of the Paris office of the N. A. C. A. and considerably curtailed the possibility of efficiently performing those functions which on May 1919 had furnished the reason for establishing that office.

The Importance of Technical and Research Work

The scientific research work done by the Committee since it was established, and especially during the last two years, has been of the highest order of excellence and has placed the N. A. C. A. in a well deserved position of leadership in aeronautics not only in this country but in the whole world. To increase the appropriation for the work of the N. A. C. A. to $1,000,000 per year would not be too much by any means if we stop to consider that no real progress can take place now in commercial aviation in this country, or in any other country, without giving the most generous support to research and development work which are the foundation of any safe and economical program of future developments in aerial transportation.

It is, I think, plainly understood by anybody who knows anything about aviation that commercial aircraft of the present day, due to their many technical limitations cannot become a factor in transportation until they reach such a stage of development that any man of ordinary intelligence and average physical qualifications can drive them safely. If we take into consideration that fact that it was only when automobiles in this country began to be numbered by millions that they became a factor in transportation, we are led to believe that even if we had 10,000 present day commercial aircraft in the air at any one time this would only mean an average of 60,000 passengers or 12,000 tons of freight being moved through the air at any one time.

It is through research and development work in aircraft, power plants for aircraft, materials and instruments for aircraft, that we shall be able to build sound commercial aircraft big and small which will not require any more intelligent driver than is required to-day for driving an automobile, car or truck, and that shall be just as safe. When we shall have reached that stage of development in aircraft design, aerial transportation will obtain the dignity of an essential industry, but not before.

The most crying need of aviation to-day is money for research and development work and this work is being taken care of very efficiently, indeed, by our National Advisory Committee for Aeronautics within the limited possibilities afforded by its budget.

At the same time, however, we have a right to ask that no money be spared for research work in aeronautics, we must insist on the adoption of a consistent program of expenditures and on co-operation between the various governmental agencies working on aeronautics.

We Need a Broader Control by the N.A.C.A. over Technical Aeronautical Matter

The National Advisory Committee for Aeronautics is responsible for most of the research work done in Aeronautics for the Government. Why should not this committee be in charge of all the work instead of being in charge of most of it? This, however we will discuss in another article.

The National Advisory Committee for Aeronautics is the officially designated depository for scientific and technical reports and data on aeronautics and maintains an office in Europe for the purpose of promptly obtaining these reports and data. Why should we need to have this work duplicated by and interfered with by the Army, Navy and all other departments interested in aeronautical developments in Europe?

Why can we not have one and only one office of Aeronautical Intelligence in Washington and one and only one branch of this office in every country where we are interested in following up aeronautical developments?

It is not with one technical assistant that the N. A. C. A. can be kept informed about what is taking place in Aeronautics all over Europe. It is not with the many limitations imposed upon the activities of its Paris office that the Committee can establish and promote a true spirit of international co-operation between governmental agencies, private concerns and individuals working on aeronautical, technical and scientific problems, both in this country and in Europe.

In a previous article, (Aerial Age December 1921), I have conclusively demonstrated, I think, that our National Advisory Committee for Aeronautics could greatly contribute to the advance of aeronautical scientific and technical knowledge in this country and in the rest of the world by taking the initiative in calling an international meeting of scientists and technical men interested in aeronautics for the purpose of reaching an agreement on a good many points demanding immediate action and cordial international co-operation.

I think I have proved that there is a demand from every quarter for such action as I have suggested and, furthermore, I think that I have proved that it is essential that any such action should be originated in the United States in order to be effective.

The point of view of the Committee on this subject, due to the stand taken by Congress on matters of foreign policy and for other reasons has been, so far, that "the committee has no right and no authority to call such a meeting".

I cannot see to-day any reason why the N. A. C. A. should not have the right and the authority to call such a meeting, and I cannot see any others than political reasons why the committee three years ago could not act upon the suggestion made at that time by its Paris office regarding the organization of technical sub-committees in Europe working in connection with the N. A. C. A. sub-committees in Washington and supplying to our Government the gratuitous advice of European experts on aeronautical, scientific and technical matters of mutual interest.

In my estimation the Aeronautic Intelligence Service of the Committee needs to be reorganized with a view of either properly utilizing the facilities offered by its Paris office in efficiently promoting that co-operation with European technical men which supplied the only reason for establishing it three and one half years ago or else it should be suppressed.

Why do We Not Restore the Offices of Scientific Attachés?

As a matter of fact why do we not restore once more the offices of Scientific Attachés to our Embassies in Europe? Are we not interested in scientific developments in Europe at least as much as we are interested in commercial, military and naval developments?

Scientific Attachés reporting to the Department of Commerce, same as Commercial Attachés, would be a very useful and timely addition to the official diplomatic family of our Ambassadors abroad.

Attached to the offices of Scientific Attachés a technical assistant to the National Advisory Committee for Aeronautics with the official title of Assistant Scientific Attache in charge of aeronautics, could perform some very good work for the Committee and for aeronautics. Especially so when a much needed Bureau of Civil Aeronautics organized under the Department of Commerce shall be created.

What we need, what the world needs, is co-operation. What aeronautics needs most is the co-operation of scientists, technical and business men of the world in the solution of present day aeronautical problems, and less, a good deal less of the military control now prevailing on every phase of development of aviation in every country.

Military and commercial aviation have no points of contact whatsoever—their problems of design, construction and operation are entirely separate, and to permeate any program of commercial aviation in this country with military and naval points of view having in mind the eventual use of commercial aircraft for offensive or defensive operations in case of war, will lead us to the same impasse which has been reached in Europe, where the failure of commercial air lines to pay even a part of their operating expenses is mainly due to the type of aircraft used, which are not well suited to the kind of service required of them.

The criticisms passed upon the present organization of the two or three Aeronautical Intelligence Services which are all trying to the best of their ability to advance the progress of aeronautics without however a great co-ordination of efforts, have been made in a constructive spirit of co-operation and the suggestions accompanying them are offered for what they are worth to those who are interested in government efficiency.

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PUBLISHED MONTHLY

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Vol. XVI MARCH, 1923 No.3

The National Aeronautic Association

THE National Aeronautic Association, in the few months of its existence, has done notable work in focussing the attention of the entire American public on the subject of aeronautics. The special National Aeronautic Association issues of *U. S. Air Service* and *Aeronautical Digest* bore testimony to the fact that outstanding figures in the business world in America are beginning to think aeronautically, and the newspapers throughout the country have been quick to recognize this fact, with the result that the newspaper press have published during the past few months a vast amount of constructive aeronautical material.

It is the privilege of AERIAL AGE this month to continue this great work. The articles which this issue contains will do much to still further public interest, and more, it will carry the story of American aeronautic unity and development to the furthermost countries of earth, for today there is not a country in the world that does not have a subscriber on the lists of this publication.

The National Aeronautic Association is to be congratulated on the excellent work that it is doing, and every reader of AERIAL AGE should endorse this good work by signing and returning the membership application blank to be found on another page in this issue.

Commercial Aeronautics

WE are privileged in being able to present the views of one of America's leading aeroplane designers on the Paris Aero Salon, and it is gratifying to have Mr. Loening assure us that America is holding its own, and a little more, in the matter of design refinement looking towards the day when commercial aeronautics will have found its established place in the world's modes of transport.

It is to be hoped that the forthcoming summer will see greater activity in commercial aeronautics in this country than we have hitherto had. The public is ready to be shown, and it is to be hoped that the manufacturers will show greater faith in their own product than they have done up to the present, by starting air lines through which the public can be educated to air travel.

Manufacturers of aircraft are naturally in the best position to start air line development, but there has been an amazing lack of interest in this phase of aeronautics by the American manufacturer. Practically every air line venture in this country has been started by men who were entirely, or almost entirely, devoid of manufacturing and designing knowledge. The results of these ventures we are all aware of.

The executive of an automobile factory would hardly think of taking a trolley car for a short journey. Road travel to him means automobile travel. So should it be with the aircraft executive. If these executives would travel by the air route occasionally—and preferably all the time—they would find that it would greatly increase their aeronautic enthusiasm, and if their mission should happen to be to Washington on aeronautic appropriations, it is reasonable to assume that worthy members of appropriation committees would be more impressed if the aircraft executive could preface his remarks with "I have just flown over from New York to talk over this matter with you".

This seems to be one of our biggest handicaps; our aircraft executives are not practically sold on their own mode of transportation, or at least if they are sold, they rarely utilize the air mode of travel.

American aircraft made an enviable record last year. Let us hope that our commercial record this year will be equally notable.

Standardization

FROM every country in the world where aeronautics is receiving scientific consideration, AERIAL AGE has received letters of commendation from the leading aeronautic engineers and designers on the series of articles which we have published from the pen of William Knight, M. E. We have provided an opportunity for the expression of ideas, and our readers know that full advantage has been taken of this opportunity. An international conference should be called to consider the very important subject of standardization, and this conference should be called by an American organization. It is well within the scope of the National Aeronautic Association to take a position of international leadership in the matter, and it is to be hoped that President Howard E. Coffin, who is now investigating the subject in Europe at our suggestion, will come back with a cordial recommendation that the N. A. A. go ahead with the conference.

Air Warfare Regulation

IN the last issue of AERIAL AGE in an article on "The International Aeronautic Foundation" by William Knight we pointed out the desirability of starting a world wide movement for the creation of a powerful moral force condemning the use of aircraft in time of war against defenseless cities far behind the zone of operation of the armies, for the purpose of demoralizing the armies at the front by killing the women and the children of the cities at the rear of the battlefields.

AERIAL AGE, as far as we know, was the first aeronautical magazine to raise this point, and therefore we feel greatly grateful in seeing that our suggestions, which were transmitted to the Hague Tribunal, have been incorporated in the recommendations made by the jurists commission appointed to discuss the rules of war according to the resolution adopted at the Washington conference.

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Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

DURING the past month, the activities of the Association have been along constructive lines and several particularly important events have taken place which contribute to the growing history of aeronautical development in this country and throughout the world.

The Federation Aeronautique Internationale

The National Aeronautic Association of U. S. A. is now the sole American representative of the F. A. I., and in the future, all contests, flights for records, sports, and meets in this country, in order to be homologated for purposes of world's records, must be under the rules and regulations of the Association by virtue of its affiliation with the Federation Aeronautique Internationale.

Under the F. A. I., the Association appoints Committees responsible for the enforcement of the rules of the Federation, issues licenses to pilots, and for meets and races; sanctions meets, races and sports; classifies aircraft; examines and passes on regulations and programs for contests; ratifies results; may bar suspended persons from participating in events; passes upon the advisibility of events; designates approval of officials and appoints timekeepers; gives official ratification to records and imposes penalties; pronounces the homologation of international events, and gives final decisions as to international records.

Pulitzer Races at St. Louis

The Contest Committee in concurrence with the Army and Navy Air Services, has selected St. Louis as the place where the Pulitzer Cup Races for 1923 will be held. St. Louis appeared to be the most suitable location for the Races, under the new conditions and regulations imposed by the F. A. I. In connection with the Pulitzer Races will be held the Annual Convention of the Association and the Second Air Congress, in conjunction with the Aeronautical Chamber of Commerce, the National Advisory Committee for Aeronautics, the Society of Automotive Engineers, and kindred bodies.

The Contest Committee is now consulting with aircraft manufacturers and Army and Navy officials regarding the details of the Pulitzer Races in order that a larger number of contestants may enter these races than participated last year when the details of the races were not decided upon until very late in the season. It is anticipated that a number of foreign contestants will be present from Great Britain, France, Belgium and Italy.

Collier Trophy

The Collier Trophy Committee, a subcommittee of the National Contest Committee, with Lieut. Colonel Frank P. Lahm, U. S. A., Porter H. Adams, Vice President and Governor First District, George W. Lewis, E. E., Executive Officer of the National Advisory Committee for Aeronautics, Chairman, and B. Russell Shaw of National Headquarters as Secretary, awarded the Collier Flying Trophy for the greatest achievement demonstrated in the actual use of aviation in 1922, to the personnel of the Air Mail Service.

In connection with this award the Committee stated that: "The wonderful achievements of the Air Mail Service in completing a year's operation along the different routes from coast to coast and in all conditions of weather without a single fatal accident, is, in the Committee's opinion, the greatest achievement in aviation made in the past year. This performance denoted substantial progress in the practical application of airplanes to the purposes of commerce and other peaceful pursuits. This excellent performance has been attained through the development of an inspection and operating system, by the Air Mail Service, which made possible the most successful demonstration of the practical application of airplanes for commercial purposes."

Accordingly, on Monday, February 5th, 1923, Dr. George W. Lewis, Chairman of the Committee, flew from New York in an Army Mail plane, piloted by Harold T. Lewis, Air Mail Pilot, having in custody the Collier Trophy, and landed at Bolling Field, Washington, D. C., where the ceremony of presentation was carried out. The presentation speech was made by Dr. Lewis for the Association and the Committee and the speech of acceptance, by Postmaster General Hubert Work, as representative of the Air Mail Personnel.

Among those present at the exercises were First Assistant Postmaster General John H. Bartlett; Second Assistant Postmaster General Colonel Paul Henderson, in charge of Air Mail; Third Assistant Postmaster General Warren L. Glover; Fourth Assistant Postmaster General Harry H. Billany; Carl F. Egge, General Superintendent of Air Mail; and a large staff of superintendents and air mail pilots; Admiral Wm. A. Moffett, Chief of the Bureau of Aeronautics of the Navy; General Mason M. Patrick, Chief of the Army Air Service, officers of the Army and the Navy Air Services, and officers and members of the National Aeronautic Association.

Mackay Army Trophy

The Contest Committee, in concurrence with the Army and Navy Air Services, Chief of the Army Air Service, and with the approval of the Board of Governors of the Association, sanctioned the award of the Mackay Army Trophy to Lieutenants John A. MacReady and Oakley G. Kelly, for the most outstanding flight of the year, 1922, it being an endurance flight when these two pilots stayed in the air 35 hours and 18 minutes. The trophy is an immense silver cup presented by Mr. Clarence Mackay to be competed for annually by officers of the U. S. Army, under rules to be made each year by the War Department, or, in the absence of a contest, to be awarded annually by the War Department to the officer or officers who make the most meritorious flight of the year.

Mr. Coffin Goes to Rome

One of the most important missions from the United States to Europe since the War is that of the delegates of the International Chamber of Commerce, who sailed on February 10th for Rome. Mr. Howard E. Coffin, President of the National Aeronautic Association, with Colonel Harold E. Hartney of National Headquarters, as his aid, are among the officials attending the Congress. For the first time in the history of international commerce conferences, aeronautics is to be represented by officials of a national aeronautic association. Mr. Coffin as the delegate of the National Aeronautic Association, and a member of the Air Transportation Group in Rome, will represent the expanding interests of aviation in the United States. Mr. Coffin and Colonel Hartney will further consult with officials of the F. A. I. at Paris and leaders in aviation in England, France, Italy and Spain regarding projected contests, air meets, and sports in the United States with the expectation that foreign entrants will be secured.

Honorary Membership to Mr. Edison

On February 12th, 1923, honorary membership in the National Aeronautic Association of U. S. A. was conferred upon Thomas A. Edison, on the occasion of his 76th birthday. Presentation of the parchment certificate of honorary membership was made by Dr. Michael I. Pupin, of Columbia University, formerly a member of the National Advisory Committee for Aeronautics. From National Headquarters, Vice President B. H. Mulvihill, and Director of Information, C. A. Tinker, were present at the ceremonies, which took

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place at the Edison Plant at East Orange, N. J.

Gliding Contests

The Committe on Gliding and Soaring Flights, of which Orville Wright is Chairman, has sent out questionnaires to the mayors of the cities and towns throughout the country together with the requirements of terrain necessary for holding glider contests, in an effort to secure information to enable them to decide where glider meets may be held in this country. At the same time, arrangements are being made to carry out gliding contests early in the coming season, with the expectation that Maynerolle and other expert gliding pilots from Europe will participate.

Meeting of the Board of Governors

The second meeting of the Board of Governors of the Association was held on January 25th, 1923, at the Racquet Club, Washington, D. C. Vacancies on the Board of Governors were filled by the election of Vincent Astor and Marshall Field Jr., of the Second District, and Charles A. Moffett, of Birmingham, Alabama, Fourth District.

A change in the by-laws, paragraph 10, article 11, under heading "Objects of Incorporation" was voted upon and the following clause added: "To supervise, control, and as far as possible, encourage, direct and advise, with reference to the sport of flying and the use of air machines to the end that such sport may be so conducted and so employed as to advance the art of flying, the science of aerial navigation, and the production of aircraft".

The following resolution was unanimously carried upon the announcement by Porter H. Adams, Vice President and Governor of the First District, that Captain Henry C. Mustin, Assistant Chief of the Bureau of Aeronautics of the Navy Department, was seriously ill at the Naval Hospital at Washington: "That a letter expressing the regrets and sympathy of this body be sent to Mrs. Mustin." This resolution was carried out.

THE NEWS of THE MONTH

Air Traffic Rules Agreed On

The section of the Aeronautical Safety Code which deals with air traffic and pilotage rules is now practically complete. Other sections of the code are nearing completion and it is hoped to have the codes ready for promulgation within the year. This code is being developed by a committee gotten up by the Bureau of Standards and the Society of Automotive Engineers, and including experts from the Army and Navy air services, the National Aeronautic Association, the Aeronautical Chamber of Commerce, and all other groups of men who are interested in air craft. Its object is to provide a uniform and well considered code of rules for the construction, maintenance, and operation of aircraft, and to serve as a guide for government regulation.

According to the traffic rules adopted airplanes on landing fields, or airdromes, have all right of way over all other traffic. Pedestrians and vehicles are not permitted on these fields except in the discharge of some duty connected with airplanes, and even then they are required to keep out of the way. An exception is made in the case of some particular area of the field which for purposes of repairs may be marked by red flags or lanterns as not in use.

Airplanes landing have right of way over airplanes taking off, both have right of way over airplanes taxiing along the ground, and a machine in distress, on fire, or with a dead engine, has right of way over everything else.

Seaplanes maneuvering on the water under their own power are subject to the same traffic rules as power vessels, and in landing or taking off they must give right of way to surface craft.

The rules in the air are similar to those at sea, with the exception that in addition to turning to the right when meeting, the higher of the two machines may rise, and the lower may dive, but they must not pass by rising and diving only. A machine overtaking another from behind must pass to the right the same as at sea.

As between different types of craft the less maneuverable has right of way. Thus airships have right of way over airplanes; balloons, captive or free, have right of way over both. Formations of several machines travelling together have right of way over single airplanes but do not have right of way over airships. An airship not under control of its own power and displaying two black balls hung in a vertical line, or two red lanterns, shall be considered as a balloon and given right of way as such.

The regulations also provide for the safety of persons on the ground. Nothing may be dropped while in flight except ballast, and this ballast must consist of water or fine sand arranged to be dropped loose. An exception is made in the case of certain restricted areas where cargo attached to a parachute may be dropped. Stunt or trick flying is prohibited over built-up areas, near airdromes, or anywhere else where it is likely to endanger others than the participants.

The altitudes at which built-up areas may be crossed are specified, these being governed by the width of the area and being so chosen that in case of engine trouble a machine will be able to land in an open area, such as park or river where its fall will not endanger persons or property on the ground. Landing in public highways or other areas not expressly reserved for the purpose is prohibited except in emergency, and then the landing plane must give right of way to everything else.

Other provisions of the code deal with the maneuvering of airplanes in the vicinity of airdromes, and the starting of their engines. The latter part is still unsettled. The signals in use in the United States differ in some slight respects from those in use in other countries, and it is hoped to get them more nearly alike in order to prevent danger of misunderstanding when an American plane lands in Canada or a Canadian plane lands on this side of the line.

Rules providing for the use of airways are included. These are lines over which air traffic regularly passes and will be equipped with regular and emergency landing fields at suitable intervals. A pilot leaving an airdrome for a cross country flight is required to notify the commander of the airdrome of his intended destination. This makes it possible to send out and look for him in case he does not arrive. He is also required to inform himself of the weather conditions at the other end of his journey.

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Aviation Site to Seattle

The Navy Department has leased Sand Point on Lake Washington, near Seattle; and, according to reports, will soon establish an airdrome there. While Seattle has held an important place in the industry, because the big plant of the Boeing Airplane Company is located there, the city has never had a landing field. Residents of Seattle are looking forward to the completion of the Sand Point project, which they hope will develop into a public airdrome.

Bureau of Standards Publishes Bibliography of Scientific Literature on Helium

Absolutely non-inflammable, yet with nearly as much lifting power as hydrogen, helium, the new balloon gas, constitutes one of the most spectacular scientific achievements of the generation, and its production on a commercial scale is a subject of the greatest interest to aeronautics.

It was discovered in the atmosphere of the sun before it was known to exist on earth, and was later found to exist in minute quantities in the air, from which it was produced at a cost of $1,700 per cubic foot. During the war it was found to exist in much larger quantities in certain American natural gases from which it is now produced at a cost low enough to permit its use in balloons. This is done by cooling the gas to within a few degrees of absolute zero, at which temperature everything becomes a liquid or a solid except the helium.

A large amount of scientific literature has been written about helium. With a view to making this literature more available to those who are interested in it, the Bureau of Standards of the Department of Commerce has issued a circular giving a list of all this literature. It is Circular No. 81, entitled "Bibliography of Scientific Literature Relating to Helium," and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy.

About 600 publications are listed, and they are so arranged under various headings that the reader may easily follow the historical development of any branch of the subject in which he is interested.

Air Mail Act

On Jan. 16, the Steenerson bill (H. R.11193) with amendments was reported out and committed to the Committee of the whole House (Rept. 1421). The bill as it now stands is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That this Act may be cited as The Air Mail Act.

Sec. 2. That when used in this Act the term "air mail" means first-class mail prepaid at the rates of postage herein prescribed.

Sec. 3. That the rates of postage on air mail shall be not less than 8 cents for each ounce or fraction thereof.

Sec. 4. That the Postmaster General is authorized to contract with any individual, firm, or corporation for the transportation of air mail by aircraft between such points as he may designate at a rate not exceeding 2 mills per pound per mile, and to further contract for the transportation by aircraft of first-class mail other than air mail at a rate not exceeding one-half of a mill per pound per mile.

Sec. 5. That the Postmaster General may make such rules, regulations, and orders as may be necessary to carry out the provisions of this Act: Provided, That nothing in this Act shall be construed to interfere with the postage charged or to be charged on Government operated air mail routes.

The rate proposed in the Steenerson bill just reported, of one-half mill per pound per mile is satisfactory to airship interests providing there are enough pounds to be carried. There should be at least 20 or 25 thousand pounds available. A third of the daily first class mail between New York and Chicago, for instance, would enable an airship company to operate profitably. Airship mail would to a large extent take the place of night letters by wire at a cost of but 8 cents a letter, with 10 cents for special delivery. The air mail would leave either terminal at the end of the day, hours after the 18-hour trains have left. From Chicago to points like St. Paul and St. Louis the mail would be taken by airplane. It is inconceivable that citizens of cities like these would wait until the morning of the following day for the mail that they knew was already in Chicago and a demand for airplane mail for the shorter hauls would be immediate. The airplane operators would naturally depend upon express and package deliveries at higher rates to add sufficiently to the income to make the routes possible.

It is admitted that this air mail to Chicago under the Steenerson bill would be about three times as costly as train transportation, but it is considered the saving in time is worth it. There is, of course, a saving in the reduction of the number of mail cars.

Figuring the New York-Chicago distance as 715 miles, at .5 mill per pound per mile the payment to the transportation line would be $35.75 for a pound. An airplane carrying 500 lbs. only would receive for the trip $178.75 at this rate.

It is obvious that any line operating airplanes would have to have planes carrying 1250 to 1500 pounds of mail in order to approximate costs—and there is not a plane in this country suitable for this work, far as known, with an engine that is economical in gasoline consumption.

Post Office figures show a cost of $1.93 per mile, including all overhead of every kind, buildings and construction; and it is likely a civilian operating company would be able to materially reduce this figure. Night flying is, of course, essential.

It is possible the public can be brought to realize the advantage of insurance of speed by putting on the 8 cent stamp, in which case the income on mail so stamped raises to 2 mills per pound per mile, or $1.43 for a pound of mail from New York to Chicago, or $715 for a 500-pound load.

That the public may be educated to this is a question. When a special rate was made for air mail between Washington and New York the purchases of these special stamps gradually dwindled to but one hundred a day. When the Cleveland-Chicago air mail route was opened up, it was possible to mail an order from one city in the morning by special delivery and get the goods in the afternoon of the same day. Merchants made a feature of this, displayed these round trip letters in their windows and advertised shoes that had been delivered before sunset. It may be possible for the various organizations interested in aeronautics to educate business to an appreciation of the returns on the added investment in postage.

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ARMY and NAVY AERONAUTICS

McCook Field's Helicopter Gets Off

The 18th of December has been marked in red on the McCook Field calendar in commemoration of the first take-off of the Army Air Service helicopter, designed by C. de Bothezat. On this day, piloted by Major T. H. Bane, former head of McCook Field, it made a duration record of 1 minute 48 seconds. On Jan. 19, for what is said to be the first time in history, Bane and the veteran old time night flyer Art Smith made several ascensions.

The machine is in the form of a four-arm spider mounted on a four-wheel chassis. At the extremity of each arm is a 6-bladed air screw, with the blades adjustable as to pitch, driven by shafts through rack and pinion by a specially re-built 170 h. p. Le Rhone engine. The air screw speed is judged to be about 60-70 r.p.m. In flight the machine has a pendulum action which will doubtless be corrected, if possible.

The machine rose straight from the ground, hovered and then descended easily. The machine has a weight of 3600 lbs., pilot and fuel included.

In the picture will be noted the rope altimeter. Whether this is the invention of the eminent Bothezat or the equally eminent army officer, an exhaustive investigation failed to disclose. This is knotted at intervals. When the last knot is off the ground the altitude is known by direct reading, no triangulation being necessary. Rumors to the effect that Bane would go after the altitude record were considered by experts to be premature.

However, the machine has great possibilities, though as a freight carrier no bootlegger would even consider it. If the Germans had had machines like this in place of observation balloons, Frank Luke would sure have been out of luck.

The National Guard in Aviation

Seven of the eighteen divisional air service units of the National Guard authorized by the General Staff are now in operation and it is hoped the balance will be going squadrons by June 30th, 1924. These seven are as follows:

Alabama—135th Observation Sqdn., Birmingham
Indiana—113th Observation Sqdn., Kokomo
Maryland—104th Observation Sqdn., 104th Photo Sec., and 104th Air Intelligence Sec.
Mass.—101st Observation Sqdn., East Boston
Minn.—109th Observation Sqdn., Photo Sec. and A. I. S., St Paul
New York—102nd Observation Sqdn., Photo Sec. and A. I. S., Staten Island
Tenn.—136th Observation Sqdn., Nashville

During the next six months it is hoped organization will have been completed of observation squadrons in the states of Pennsylvania and Ohio.

All equipment in the way of airplanes, and accessories are obtainable as free issue from the Army Air Service, after such material has been declared surplus. The planes are JN4Hs and JN6Hs. The Regular Army flight instructor on duty with each outfit has a DH4B for his own use.

The seven squadrons already organized participate regularly in flying, in spite of the fact that they draw no flying pay. Legislation is now up to give them increase when on flying status.

The nucleus of each squadron is comprised of officers who have had world war service as pilots or observers. For replacements there are three pools: first, from the school now being conducted at Brooks Field of four months' duration, at which non-flying officers who are members of these squadrons receive instruction which will qualify them as junior airplane pilots—there are 12 now at this school; second, the Chief of Air Service has arranged to allow two or three enlisted men from each National Guard squadron to taek the regular cadet course each year; third, any man who has been unable to qualify at a service school but who has done considerable commercial flying is allowed to take an examination both in flying and in Air Service subjects, upon the satisfactory completion of which he becomes a junior airplane pilot if he can pass the same

The De Bothezat Helicopter © Army Air Service.

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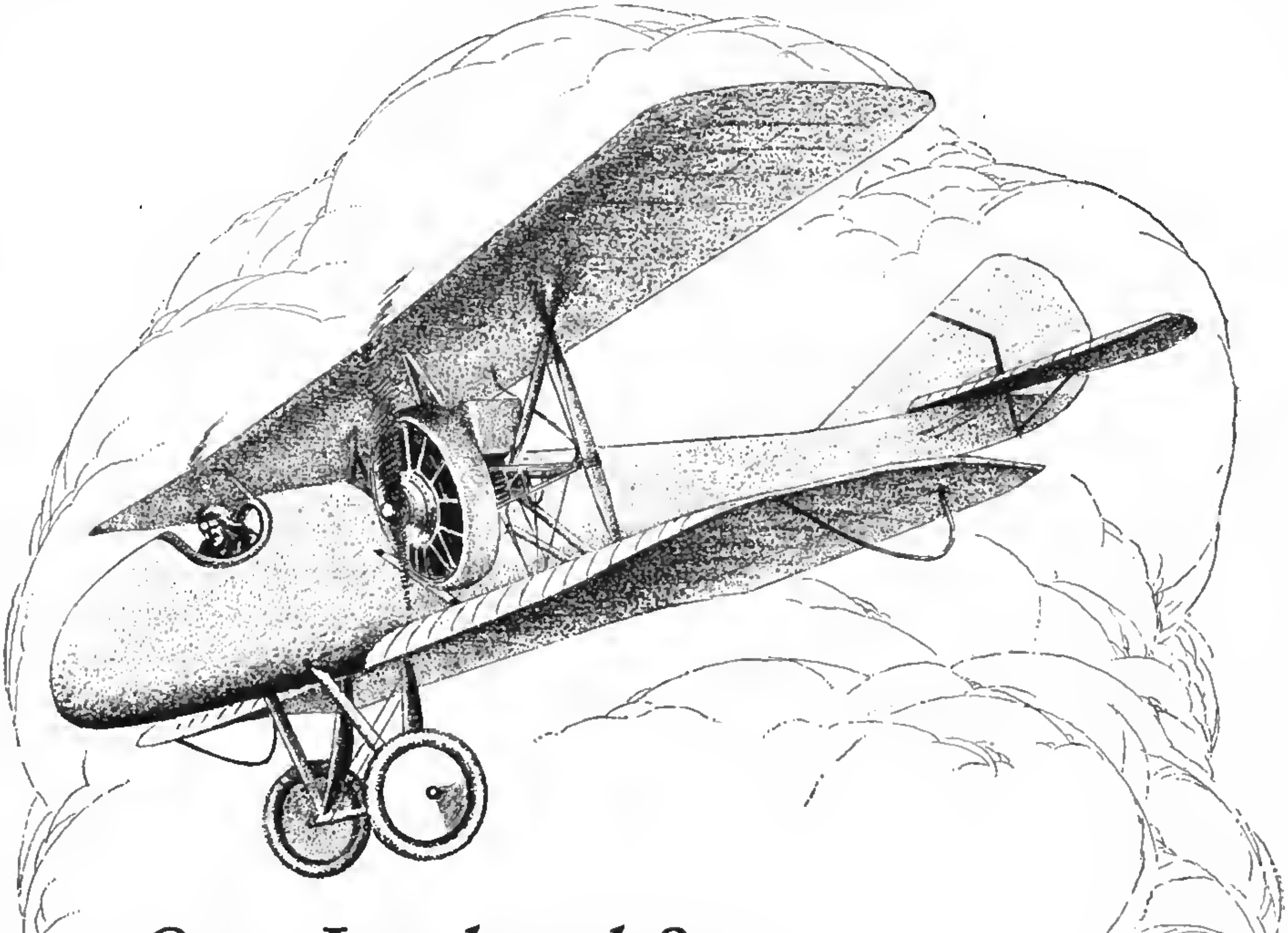

Over Land and Sea—

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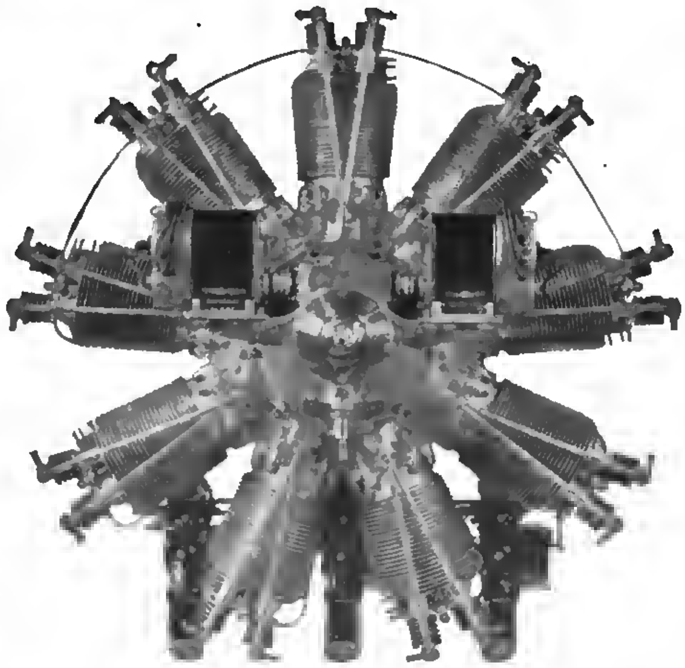

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Huff Daland Aero Corporation announces the closing of its Kansas City office during the winter months and the shifting of its sales and flying force to the main office at Ogdensburg, New York.

Improvements developed in cantilever training planes produced for the Army & Navy during the past year are being incorporated in the new Petrel for 1923.

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By Arthur R. Blessing

Commercial Aviation—Some Truths on the Subject

By P. D. Johnson

The Timing of Airplane Races

By B. Russell Shaw

Airway Landing Fields

By Lieut. C. E. Crumrine

An Open Letter To The Members Of The Sixty-Eighth Congress Clearly Outlining Their Duty To The American Aeronautic Industry

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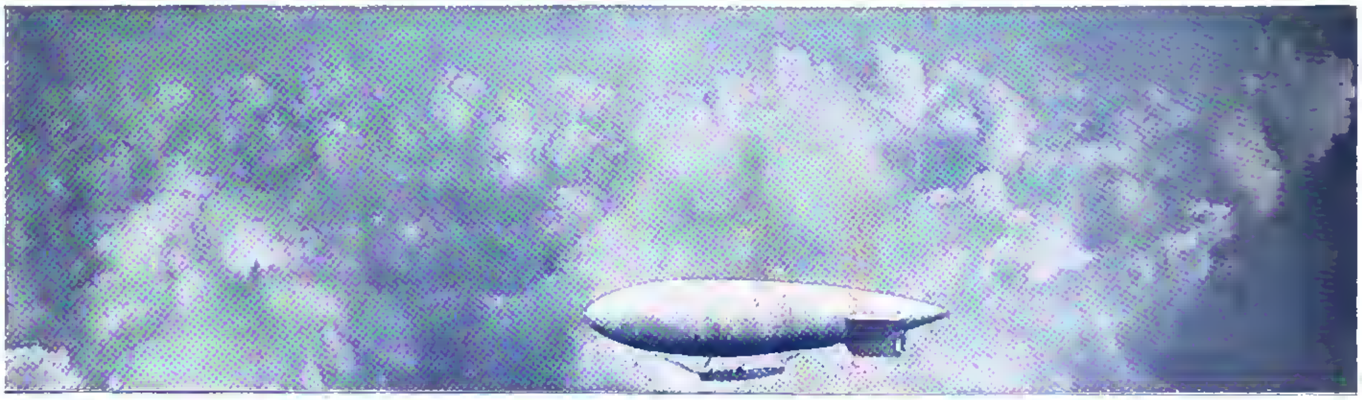

THE HELP THAT AVIATION DESERVES

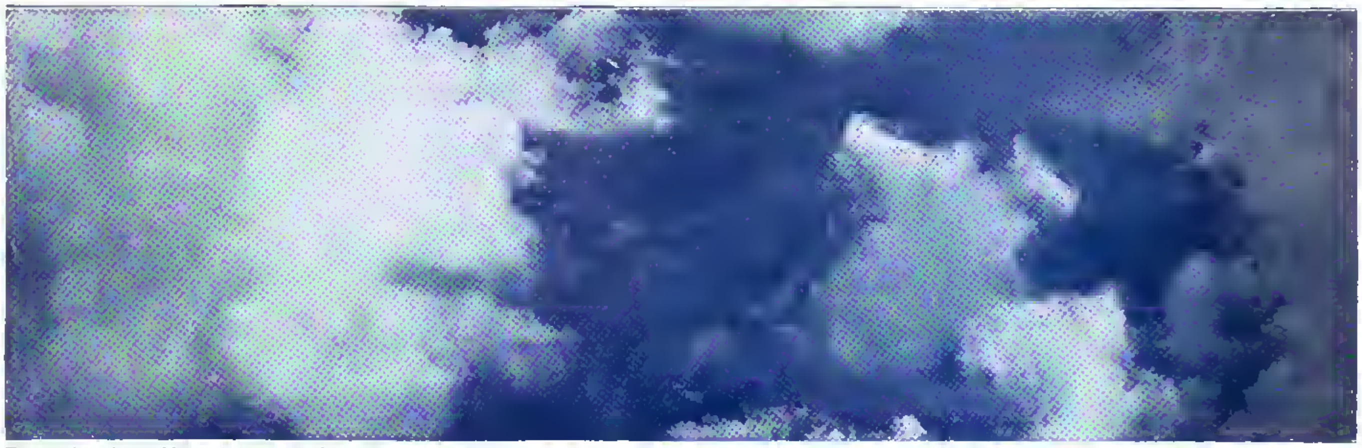

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TABLE OF CONTENTS

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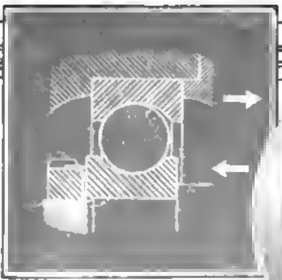

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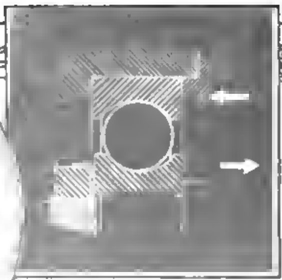

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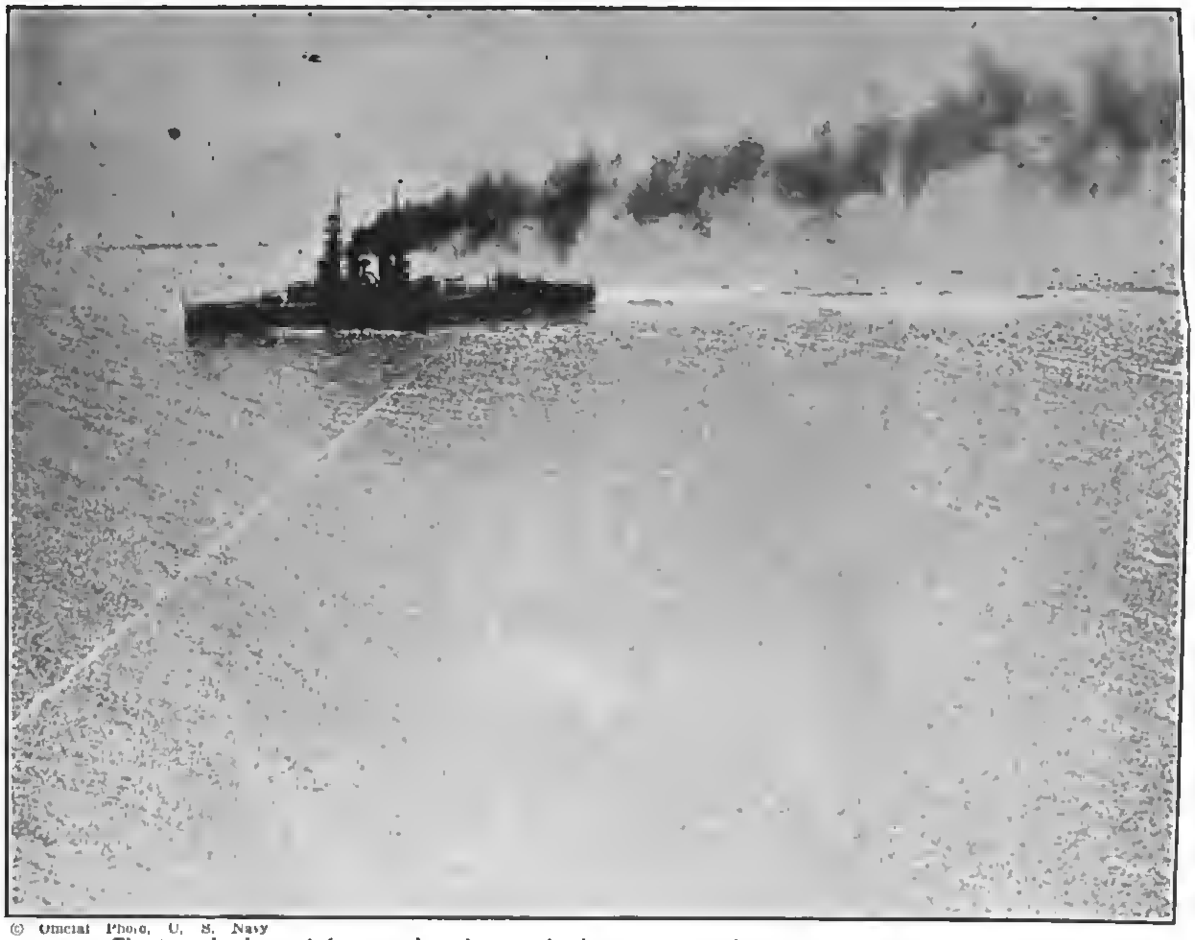

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The torpedo dropped from a plane is sure death to war vessels. A torpedo making a direct hit against the Oklahoma

The Development of Air Power Policy

By Arthur R. Blessing

THE Versailles peace conference and the Washington armament conference both diplomatically sidestepped the important question of air power policy. Aircraft constitute a comparatively recent development and a brief résumé shows that it is destined to play a very significant part in future national and world policies.

Policy is defined by the Century dictionary as follows: "The object or course of conduct, or the principle or body of principles to be observed in conduct; specifically, the system of measures or the line of conduct which a ruler, minister, government, or party adopts and pursues as best for the interests of the country, as regards its foreign or its domestic affairs."

Just how may this definition be applied to air power, either past present, or future? Air power in the recent past has played an important rôle in national and international calculations. At present, practically every country is including air service in its financial estimates for defense. The fact that, except in a general way, air craft was left untouched at the Washington conference has furnished a wide scope of possibilities for future shaping of both foreign and domestic policies all over the World.

No country can now consider itself isolated and this inescapable conclusion must be taken into account. Control of the seas has always been the most important object in view. But now the control of the seas will have to be secondary to or at least parallel with the control of the air.

The history of air power policy is necessarily a recent one. Prior to about 1910, it did not figure to much extent in the considerations of international or even national questions. Since the close of the American Revolution, sporadic attempts have been made to use balloons and kites in warfare; but not until the present century has air power been used very effectively. In 1910 the British military authorities first began to consider seriously the possibilities of the air service as an auxiliary aid to national defense. The year 1911 is recorded as having been the first to see actual use of an airplane in warfare; when in fighting on the Mexican border, airplanes were used for reconnaissance work.

In the Balkan wars, the new arm of defense and offense first began to loom up as a serious factor. In the war between Italy and Turkey, airplanes were used principally for scouting; however, airships proved rather more effective in bomb dropping. From this time until the European war broke out, the prospective belligerents bent all energies towards developing and perfecting their aircraft for war. However none of the nations as yet realized the changes in almost every branch of aviation that the War was about to produce.

At the beginning of the War, avia-

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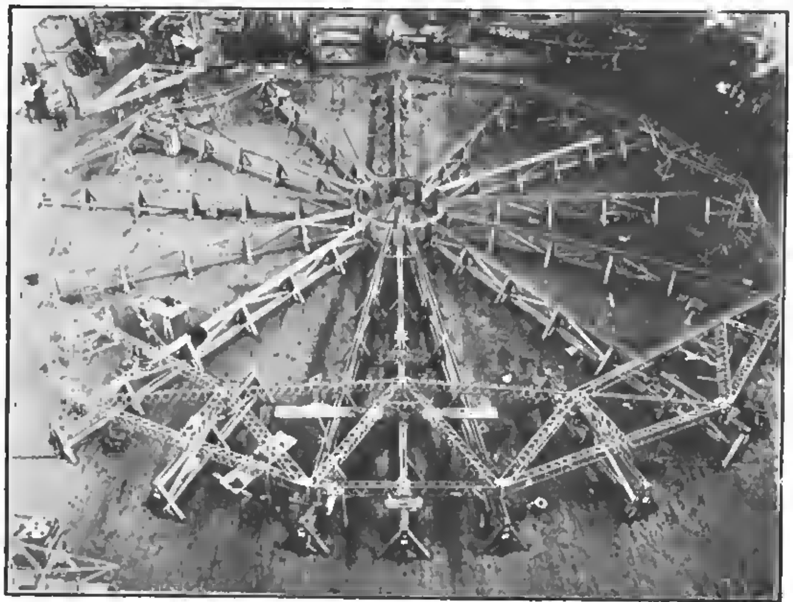

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Assembling the ZR1 at Lakehurst, N. J. The first American-built airship

tion was still in a more or less scientific state of experimentation. The machines were low-powered and crude. They had no equipment either for real fighting or for adequate reconnaissance; and could stay in the air only a comparatively short time. The pilots had had no previous war experience and simply had to develop their own technique of fighting, both defensive and offensive.

After aviation as a fighting force began to be taken more seriously by the military authorities, specialization started to grow and many new types of fighting aircraft were evolved. As the War progressed, aviation development became more and more extensive, and all sorts of accessories, organizations, formations and the like came into prominence.

Definite control of the air became a prime necessity and no formation of aerial tactics was too elaborate to gain this control. Back of the fighting lines, an entire new organization had to be built up to furnish supplies and to make repairs. Industry had to be recast so as to furnish the airplanes, their engines and other mechanical necessities. All of this activity was consciously or unconsciously moulding a definite air policy.

The committee on aircraft at the Washington conference felt that aviation was entirely too large a proposition for them to handle and recommended that a later conference be called to discuss this subject by itself. Although agreement was reached on limitation of aircraft carriers, this means comparatively little taking the matter as a whole.

The general air policy of every country is now looking toward an unquestioned security within its own territorial limits. Bases are being established that will adequately support this policy. Though a country may be insular or continental, it is entirely capable of developing aviation. Assuming that a country is too poor to afford one battleship of the Dreadnaught type, it can nevertheless build and equip several airplanes at less than half the cost of a small cruiser. Little countries, adequately provided with airplanes will have to be considered in future diplomatic channels. A larger power will be able to help organize the air forces of several small countries and thus have many potential allies in case of future conflicts. The so-called balance of power will be subject to more severe fluctuations, now that an arm of service is not limited to a few rich nations.

The domestic policies concerning aviation are inextricably tied up with commercial flying, with all of its problems of governmental control and regulation, subsidies, aeronautical associations and allied questions. With the exception of the United States practically all of the larger countries have granted subsidies to civil aviation since the War. This has been a great factor in keeping alive the aviation industry, causing large manufacturers to train pilots and mechanics, to develop aircraft as a transportation unit, and to popularize the whole scheme.

It is apparently universally realized that the next decade is to be a critical period of time and that these few years will really provide the foundation of this new industry. Governmental regulation of some sort has been already provided in most cases and will be an absolute necessity in all, in order to provide a standardization and a consistent program to be followed. This applies not only to the commercial side of the industry but to the training of personnel, mapping of the country, and co-operation between goverment departments.

The more that commercial transportation by air can be increased, the more familiar will the layman become with aviation and the more readily will he contribute to its advancement. Aeronautical associations also are being extensively organized all over the world. The new National Aeronautic Association in the United States is a typical example. Commerce demands speed, and many countries have taken up aerial mail service. This phase of aviation has proved so successful that it is being rapidly extended.

From the military point of view, all of the large powers with the exception of Great Britain have preferred to keep the Army air service and the Naval air service as distinct units. Great Britain on the other hand failed in this scheme but since 1918 has successfully built up a separate aviation corps called the Royal Air Force.

An aircraft policy for national defense can be quite advantageously controlled and regulated by the government; but control for civil aviation is a different matter. In countries where subsidies have been granted, it is easier than where this plan has not been adopted. At present, aviation conditions are rather chaotic in the United States but there is a bill now pending in Congress designed to correct this state of affairs. This bill is intended "to create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes."

The question of the actual value of the new air service to the older military and naval services is still open to discussion and is much debated. Tests in the United States have been made of the effect of bombs on obsolete battleships. While these tests were not made under actual warfare conditions, the results were rather startling to the average observer. The following extract from the Report of the Joint Board on Results of Aviation and Ordnance

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Tests held during June and July 1921 gives an authoritative opinion on this controversy: "The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provide, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed." It is thus quite definitely concluded by a body of experts that aircraft are a necessity to both the military and naval branches of defense.

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Naval air squadrons of the Pacific go into camp on the Pacific Coast

In the formation and development of an air power policy, there are many factors that must be taken in to consideration. War as an institution cannot be said to be over. Every nation feels that it cannot afford to neglect aircraft because of its sheer potentiality of force if for no other reason. Success or failure of a nation's policy depends in great measure upon the amount and character of armed force behind it.

Probably the outstanding factor to be considered in aircraft policy is SPEED. Not only speed itself but its intimate relations to mobilization, transportation, protection, and action, both offensive and defensive. The element of surprise plays a most effective part in war. Thus far nothing has been devised that can exceed the speed of aircraft and their consequent ability to surprise the opposing forces. The possibility of mobil-

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Looking North over Havana, Cuba, and entrance to the harbor

izing the military and naval forces may depend to a large extent upon the outcome of the initial aircraft movement.

Not only are airplanes a protection to the transportation of troops and supplies by land and sea; but they constitute a guard to large dirigible airships. The latter are being rapidly developed as a means of relatively quick transportation and some authorities maintain that they will be a most decisive factor in future calculations of logistics.

The aircraft will be able to carry their own airplanes as well as supplies, thus obviating the necessity for the protecting craft to return to their bases. This will considerably increase the radius of effective action. With the ability of both types to operate in the same medium, an airplane flying slowly can alight on the top of a dirigible without the need of the latter changing its speed or direction. This is an obvious advantage over an airplane alighting on an aircraft carrier as the latter is of course subject to the motion of the waves.

Meteorologists state that there is a constant wind of about 250 miles per hour velocity at a level of approximately seven miles above the earth's surface. This wind is always present and is perpetually blowing from West to East. Assuming an average speed of 100 miles per hour, this would indicate a relative aircraft speed of 350 miles per hour in an easterly direction. On account of the extreme altitude, it is problematical just how much of this level can be used as a practical route. Also the fact that this wind blows in only the one direction has a direct bearing on relative speeds in returning from East to West.

In the consideration of aviation bases and their supplies, it is quite apparent that bases for aircraft would not need to be very close together. An American aviation expert asserts that with one adequate base in New Jersey, the entire coast from Chesapeake Bay to Boston can be easily defended. Aircraft in distress can communicate with their bases by radio and summon supply or repair airplanes to be sent out to their aid.

The psychological factor is a great determinant in the formation of any policy and peculiarly so in relation to air power. Many conflicting statements have been made relative to the German airship raids in England during the late War. However, the consensus of official opinion seems to be that their moral effect was very great, particularly in the industrial cities.

There is no doubt but that a future conflict will involve the entire civilian populations. Formerly battles on the sea affected only the combatants directly. On land, only the civilian populations suffered that occupied the country being actually invaded by a hostile army. However aviation extends the theater of war measurably and the fear of the unknown tends to break the general morale in all sections of the invaded country. Marshal Foch in urging air defense for France made the following significant statement:

"One of the greatest factors in the next war will be aircraft. The possibilities of aerial attack are almost incalculable; but it is clear that such attack, owing to its moral effect, may impress public opinion to the point of disarming the government."

Another angle of the psychological effect and its consequent reaction upon national consciousness was clearly shown by the successful trans-Atlantic flight of the United States flying boat, NC-4 in May 1919. This was a most impressive demonstration of the extensive use to which large aircraft can be put. The effect was further enhanced by the remarkable non-stop flight of a British bombing plane from Newfoundland to Ireland in June 1919; and also the flight of the R-34, a British dirigible that cruised from Scotland to Long Island in July 1919. The proposed "trans-Pacific and "Around-the-World" flights will cause a still stronger feeling as to the potential possibilities of aircraft. The latter contemplated flight may be especially compared to the sending around the World of the United States fleet by President Roosevelt in 1908. That this voyage was a most impressive psychological determinant in policy and caused a great addition to American national prestige cannot be denied.

Inasmuch as the passage of aircraft in both peace and war is subject to international rules and regulations, the question is at once raised as to how the nations have already dealt with this matter. In the first Hague conference in 1899, it was proposed "to prohibit the throwing of projectiles or explosives of any kind from balloons, or by any similar means". Despite the intermission of less than a generation, it was a far cry from that time to the bombing operations of the European War. Policy changed over night and all suggested international codes for aircraft were thrown to the wind.

In the Versailles peace conference, a committee took up the aircraft question and decided that every state has complete and exclusive sovereignty in the airspace above its territory and territorial waters. As this treaty was not ratified by all the belligerents, the international status of aircraft is still undetermined. Sooner or later, an international convention of some sort must be held to take up this increasingly important matter. Considering the mobility, speed, and ability of aircraft to cover great distances, no analogous land or sea vehicle rules can be adopted bodily by aerial navigation.

An outgrowth of the conference at Versailles referred to above is a so-called International Commission for Air Navigation, functioning under the League of Nations. Although the provisions of this commission do not directly affect non-members of the League, they provide an excellent foundation for any future aerial navigation agreement that shall be truly international in scope. The rapidity with which situations are changing in regard to aviation makes any policy, particularly one of international action, out of date almost as soon as it is written. Hence there is a tendency among the powers to let this important question drag along indefinitely.

Prophecy is dangerous! This is especially true concerning a subject that seems to be in such a state of flux as aviation. However the near future will in all probability reveal developments that will materially alter any aviation policy in force today. The tremendous changes due to be made because of pilotless, gyroscopically-controlled flight of automatic airplanes will cause many problems. Another consideration is wireless control of naval vessels, aircraft and torpedoes. The ability to pilot an airplane and send printed radio messages to land stations by means of a small contrivance resembling a typewriter will almost revolutionize intercommunication.

Mechanical inventions such as the helicopter that ascends and descends in a vertical plane must be taken into account. Although gliders are comparatively unstable for military purposes, the suggestion has already been made that they be fastened to motor-powered aircraft and used, as trailers are now used behind a motor car.

While some ideas seem marvelous and others foolish, it was only a generation ago that aviation itself was little more than a dream. Today it is almost too large a proposition for national and international consideration. Tomorrow simply cannot be visualized to much extent, and na-

(Concluded on page 181)

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Wellesley College from the air—a good example of aerial photography.

Commercial Aviation: Some Truths on the Subject

By P. D. Johnson, of the Boening Aircraft Corporation of Seattle, Washington and Vice-President and Governor Ninth District National Aeronautic Association of U. S. A.

IGNORANCE and exaggeration are the Scylla and Charybdis of aviation. The monstrous Scylla barked like a dog. She had six long necks supporting six frightful heads. In each head were three rows of deadly fangs. Woe to all who came within her reach. Yet, despite her ravages, she did no more harm to progress in her day and age than the ignorant blasts of would-be aeronautical experts are doing today. And the public, at the hands of aeronautical exaggerators, is called upon daily to swallow a bigger load than Charybdis ever did, although that horrible creature swallowed the waters of the sea thrice every day and thrice threw them up again.

Munchausen-like we have overshot the mark without romantics and heroics of the "conquest of the air", and, at the same time, we have pushed grim pessimism to the extreme in our front-page stories of the disasters "conquest". Such perversion is utterly wrong: it endangers public misconception; it serves no useful purpose.

We must apply a discount of one hundred per cent to the croakings and skepticisms of those who see in aviation nothing more than a swift and somewhat messy method for crazy aviators to kill themselves along with their silly trusting friends. And, by the same token, we must do the same thing to the extravagant claims and romantic theories of those who recognize in aviation the one and only accomplishment of the race, perhaps mentioned in Revelations, the belated appearance of which has been holding back the millenium.

"Pitiless publicity", if truthful, will not endanger aeronautical progress where the general public is concerned; it will help the more. For, with both doubt and mushy glamor stripped from actual accomplishment, we find that no other mechanical achievement since man came out of the prehistoric caves has advanced so far in so short a period as the science of aeronautics. Its astounding record needs no apologies nor support beyond the truth.

While much of the rapid development in aeronautics must be credited directly to necessities incident to the greatest of all Wars, the only legitimate use for aviation in this world is *Commercial*. Used as such it is a blessing. Used otherwise it is a curse. For if the future major effort in the development and operation of aircraft is to be military and naval, as some claim, it would have been better for the world had such a thing remained unknown.

As a weapon, or a conveyor of weapons, nothing so deadly and inhumanly efficient as unopposed aircraft has ever been conceived by man. Nothing is safe from the airplane or airship; towns and cities on the seacoast or far inland are easy prey. Quite the opposite to defense in land warfare, there is more danger than safety in numbers and concentration against aerial foes. Death-dealing bombs, annihilating gases, liquid fire, lives snuffed out in countless numbers and destruction unnamable lie in the wake of wartime aircraft.

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We hear from all sides that America is lagging behind Europe in every phase of aviation. This is less than a half-truth. Leaving military and naval considerations out of the discussion, and notwithstanding continued governmental indifference, commercial aviation in the United States is making encouraging progress. We are little, if any, in the rear of European achievement. To be sure, Europe has a great many air transport lines operating on regular schedule, while we have but a half-dozen. But when flying in Europe is compared on a mile-for-mile and passenger-for-passenger basis with what is being done in this country we find no cause for shame or discouragement.

In aeronautical research, with the possible exception of Germany, driven to research by Allied restriction and control of aviation, we lead the world. Our Air Mail is the most successful and by far the largest single air transportation enterprise in the world. We have the largest company in the world which operates air boats on commercial lines. American equipment holds the endurance, speed and altitude and long-distance, non-stop records of the world. This is not boasting, it is the recital of facts, known to those who follow the records of the science and art.

Yet the record of aviation in this country is so far short of what it should be that one is led to believe that the American public is the most patient known to civilization. This is a logical and obvious conclusion when one appreciates the importance of air navigation to a nation like this one of ours. The very geographical characteristics of our country, with its immense domain, with large urban centers scattered through its broad length, and the ever increasing value of *time* in mercantile and industrial transactions make it emphatically and undeniably true that we must employ air navigation on a grand scale to supplement existing methods of surface transportation now in use and some of which are now rapidly becoming obsolete.

The chief cause of general inaction toward aeronautical development in America is the lack of laws to foster and govern its growth. However, the Civil Aeronautics Act of 1923, introduced into the House of Representatives on January 8th, by Hon. Samuel E. Winslow, Chairman of the Interstate and Foreign Committee, one of the most constructive legislative measures placed before Congress since the Wright Brothers gave to the world mechanical flight on December 17, 1922, seems to meet the present needs.

This bill provides for a Bureau of Civil Aeronautics in the Department of Commerce, and is the first step made by our government to make flying safe and sane and to place it on a parity with other interstate transportation activities.

As stated, the development of commercial aeronautics in this country has been held back by reason of the non-existence of laws regulating and fostering aeronautical enterprises. Non-regulation has been the cause too, of practically all the fatalities in flying outside of the military and naval establishments.

This Civil Aeronautics Act, will establish and promote the aeronautical industry and commercial air navigation throughout this country, by providing for the authorization and the carrying out of the inspection and licensing of aircraft and pilots, establishing certification of aircraft routes and terminals, establishing rules of the air and air administration and co-ordinating, the Military, Naval, Postal and Commercial activities of the country into a great cohesive enterprise, which will be of tremendous economic benefit and one of the most important factors in the national defense.

Those private concerns operating aircraft, which most closely approximate the standards of the regulatory measures in the proposed act in connection with the conduct of their business, in the last two years have carried thousands of passengers without a fatality. The fatalities in commercial flying have been due to itinerant and gypsy fliers, who, however, carried several hundred thousand passengers and caused one fatality in every 600,000 miles of flight; a record placing the safety of flight in the United States ahead of every other country in the world.

It is also true that the total mileage flown in the United States has exceeded the combined mileage of all the countries in Europe. It will thus be seen that the use of Aviation on a grand scale in the United States has really been waiting upon the enactment by Congress of such legislation as that proposed by Congressman Winslow. Capital has been skeptical of aviation because it has been an "outlaw" activity doing an interstate business without the aid of interstate laws. Hence insurance companies have either refused to write aeronautical insurance or have charged such tremendous premiums that insurance was out of the question.

The National Aeronautic Association is squarely behind this constructive act and sees in its passage the removal of the last barrier preventing the complete development of aviation in the United States. By the enactment of the Winslow Bill, thus encouraging the investment of capital, there will be added to our present transportation systems that swiftest of all methods of passenger, freight, and mail carrying: Aviation.

The Zeppelin "Bodensee" passenger carrying airship © Harry Vissering

The Timing of Airplane Races

By B. Russell Shaw, Executive Vice-chairman Contest Committee N.A.A. of U.S.

The methods used in timing the national races at Detroit last Fall were, without doubt, the most complete and accurate ever employed in an aeronautical meet. The electrical timing and recording device insures an accuracy impossible by any of the other methods generally adopted. Aerial Age *feels that Mr. Shaw's article is of prime interest to every aero club in the world.—Editor*

THE timing apparatus is one of two constructed by Mr. A. P. Warner, of the Warner Speedometer Corporation, Mr. Harry K. Knepper of Detroit, and Mr. Ode Porter of Indianapolis, Ind. Mr. Porter has worked for over eleven years on the present timing machine, adding new features until now its action gives unvarying time down to 100th of a second in a printed record which can be checked for absolute results. The actual timing apparatus consists of a certified chronometer of exceptional accuracy under all climatic conditions, having been tested at the Bureau of Standards and Naval Observatory at Washington, D. C. The certificate of performance is remarkable in that the variation under extremes of temperature is practically negligible and as stated by the report received from the Bureau of Standards: "The chronometer is one of the most perfect that has ever been tested in this institution." This chronometer is electrically connected to an instrument, the construction of which would require a lengthy and technical description. Therefore, only its general construction will be touched upon.

This timing machine consists of a small 30 volt motor geared down to run a shaft ½ revolution per second, on this shaft are 4 disc wheels; namely, hour, minute, second and hundredths. The hour is numhered from 00 to 59, the minute is numbered from 00 to 60, the second is numbered from 00 to 60 and the hundredths is numbered from 00 to 95 around to the half, and the other half from 00 to 95. This hundredths wheel is scaled by hundredths and is secured to the shaft hy a small ratchet and at end of shaft is a cross piece of hardened steel, called governor, as this shaft will run about 5 hundredths fast, allowing the correction to be made every half second hy the aid of the ship chronometer in which is attached to the escapement lever, a contact that makes and breaks with each second. This contact is operated with 6 volts, with a 2 MF condenser. This contact operates a relay which makes a contact with two 12 volt coils called governor coils. These coils are magnetized every second and operate a bar in such manner as to retard the governor yoke or cross piece every second. The other wheels on shaft are free and held in position by three 8 tooth pinions, of 4 long and 4 short teeth. As the hundredth wheel makes ½ revolution, this pinion advances the second wheel one number or second and every revolution of the second wheel, the other pinion advances the minute wheel one number or minute and so on with the hour wheel. On top of these wheels a paper tape 2¼" in width is automatically fed, and on top of this paper tape is a printing ribbon which extends across the paper tape and the four timing wheels. Directly above these wheels are four small hammers, set into a square frame hinged in the middle, the opposite end being drawn up by two 12 volt magnets, throwing the hammers down upon the print ribbon, paper tape and hour, minute, second and hundredth wheel, thereby getting the impression of the figures on the four timing wheels which will give the time to the one hundredth part of a second. A hand trap having a closed contact is in series with a relay of 6 volts, this relay makes contact with the 12 volt unit coil. This trap is connected with the instrument by an electric cord of arbitrary length. It has been found that the hand can be contracted with greater certainty and more quickly than the finger pushed on a button. This handle is therefore gripped entirely by the hand of the timer, who sits under the sighting wires and contracts the handle the instant a plane passes through the plane of the sighting wires. The failing of the hammers to print the time, momentarily stops all the printing wheels so as to get a perfect print, and they then are released automatically and a spring on each printing wheel makes it catch up for the time lost while the time is being printed.

By using a circuit through which the current is constantly flowing, in which a bank of lights is placed in series, it is possible to tell the instant the circuit becomes inoperative. This accounts for the fact that the breaker in the hands of the timer breaks contact when the hand is contracted. When the time of the plane is taken the number is called out by the timer as he contracts the breaker. The recording timer who is in charge of the instrument writes the number of the plane opposite the time as it is stamped on the tape. The tape passes from the machine to the scorers who set down the times, thus indicated, on their score sheets.

In the contest for the Curtiss Marine trophy, October 8, 1922, in which 160 miles were flown over a 20-mile course a timer's stand was erected opposite the lower turning pylon and in a direct line with the starting and finishing line designated by colored buoys anchored in the river. On top of the timer's stand a pole was erected approximately 15 ft. high. This was placed about 12 ft. directly behind the position for the timer and in line with the starting and finishing lines. From the top of the pole a taut wire was extended downward at an angle of approximately 45 degrees to the end of a horizontal spar pointing outward in front of the timer's position.

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Ode Porter, who with H. K. Knepper, invented the timing apparatus shown

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Five feet from the top of the vertical pole another wire was attached and carried down to the same spar and attached 5 ft. back from the end. These wires were very carefully trued vertically and lined up, exactly cutting the starting and finishing line and at the same time establishing a vertical plane into infinity so that the timer by sighting across the two wires either vertically or horizontally could "clock" a plane the instant it passed through the imaginary plane thus established through the sky.

National Airplane Races

The same general conditions were used in timing the National Airplane Races on Oct. 13-15 as described in the foregoing paragraphs, the only change being that the timer's stand was erected about three quarters of a mile below the turning pylon located on Selfridge Field. The stand was approximately one-half mile from the normal line of flight. The sighting wires were established in a similar manner to those described above and the plane through the sky was at exactly 90 degrees to the line of flight laid out by the U. S. Lake Survey Office. Starting and finishing lines were marked across the field in a three foot strip of white, extending from just in front of the timer's stand across the field and 100 ft. beyond the normal line of flight. This made it possible for the plane to make a wide turn and pass over starting and finishing line at any position and any altitude without causing inconvenience or inaccuracy on the part of the timer.

During the races on October 12th and 13th the three turning pylons situated at Gaukler's Point, Packard Field and Selfridge Field, respectively, were connected with the timer's stand by an uninterrupted open telephone circuit. As each plane passed a pylon a judge announced the passing into the telephone transmitter. This turning was then recorded by a Scorer seated in the timer's stand and equipped with head phones. This made it possible to know at all times the exact location of every plane on the course, and also to determine where a plane had a forced landing in case its pylon turning was not announced at approximately the proper time.

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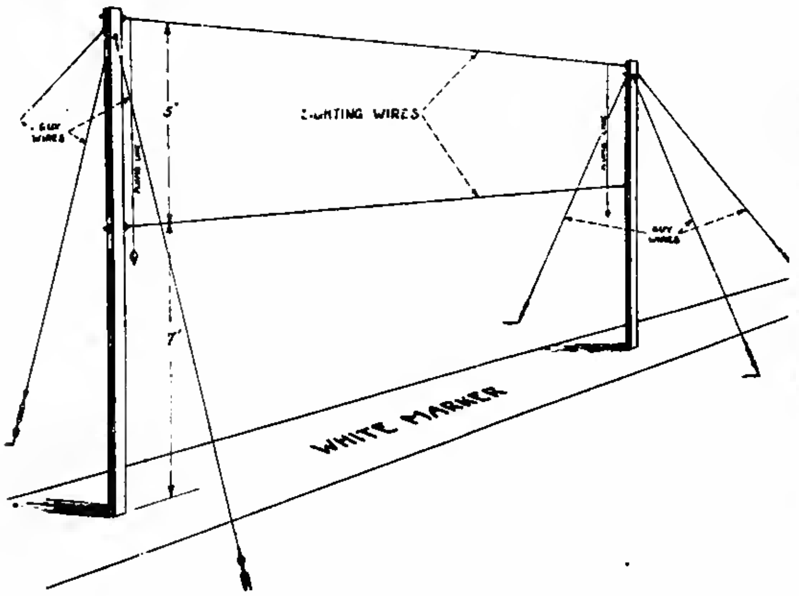
Photo showing sighting wires at timer's Stand

In the Pulitzer Race on October 14th the turning pylons at Selfridge and Gaukler's Point were connected with the same circuit used the day before and the U. S. Steamer *Dubuque*, which marked the turning pylon out on Lake St. Clair, was in constant communication by wireless to a powerful transmitting and receiving set located on the timer's stand. In this way the same relative communication was had as that used on the previous two days.

Establishing World Speed Record

The U. S. Lake Survey office supplied two of their expert surveyors who laid out a course on Selfridge Field to comply with the requirements established by the F. A. I. The course was measured off as nearly into the prevailing wind as possible. The one-kilometer distance being established approximately across the centre of the field in a diagonal direction. A stake was driven in the ground and the kilometer measured by the Government surveyors using a standard steel surveyor's tape. The course was kept in a perfectly straight line by means of a transit and a second stake driven at the far end of the kilometer. The distance was then checked back for correctness. The required 500-meter distance was next laid off beyond each end of the kilometer to conform with the F. A. I. requirements, and clearly marked by stakes. An observer was stationed at each of the 500-meter distances and supplied with large white flags to mark this point. At each end of the kilometer two horizontal wires were placed one above the other, five feet apart, the lower wire being seven feet from the ground. The wires were placed directly over the stakes driven into the ground by the surveyors and lined up vertically with plumb bobs. The timing apparatus, which was the same as that used during the previous days' races, was set upon the field at one end of the kilometer straightaway. Two electric cords with breakers were attached to the instrument, one to be used by the timer at one end of the course, and the other attached to a long wire extending down the field for use by the timer at that end. A field telephone was also used to give constant communication between each end of the course. Timers and observers were stationed at both sets of sighting wires, and the ends of the kilometers were marked with large red flags.



Timer's sighting wires

The Efficiency of a Wind Tunnel

By William H. Miller

THE most satisfactory definition of the efficiency of a wind tunnel should give as extreme limits of numerical evaluation: zero and unity. It is highly desirable that the resulting mathematical expression should show how such factors as the motor and the fan efficiencies affect the overall efficiency; and, furthermore one should be able to develop from such a definition the efficiency of the "tube" alone.

A state of steady motion of a perfect fluid in an *ideal* wind tunnel would exist indefinitely, as there would be no losses. In the actual tunnel, the function of the motor-fan group is to overcome the various losses. The *useful* energy may therefore be conveniently defined by the kinetic energy, E_e, in the experimental chamber; that is

$$E_e = \tfrac{1}{2}\rho A_e V_e^3 \qquad (1)$$

where ρ is the absolute density of the air, A_e the cross-section area of the stream in the experimental chamber, and V_e the mean velocity in the experimental chamber.

The total amount of energy transformed in unit time by the complete unit is ($E_e + E_s$), where E_s is the energy supplied *to* the motor. The *overall* efficiency of the complete unit may then be defined by

$$\eta_o = \frac{E_e}{E_e + E_s} \qquad (2)$$

If the brake-power and efficiency of the motor be respectively designated by P_m and η_m, it is evident that we may also write

$$\eta_o = \frac{1}{1 + \dfrac{P_m}{\eta_m}} \qquad (3)$$

In defining the efficiency of the tube and fan as a separate unit, it is only necessary to charge to the unit the amount of energy given by

$$E_e + E_s - (E_s - P_m) = E_e + P_m = E_e + \eta_m E_s$$

since P_m is the brake power absorbed by the fan. For this unit, with efficiency η, we have

$$\eta = \frac{E_e}{E_e + P_m} = \frac{E_e}{E_e + \eta_m E_s} \qquad (4)$$

It is now easy to see that, in order to obtain a definition of the *tube efficiency* we need only charge to the tube the kinetic energy in the experimental chamber plus the work done in unit time by the propeller *on* the air; thus

$$E_e + E_s - (E_s - P_m) - (P_m - P_u) = E_e + P_u$$

where P_u is the useful power delivered by the fan, and must be equal to the total loss of head, H_f, due to friction, multiplied by the *weight* of air handled in unit time; that is $P_u = g\rho H_f A_e V_e$. The tube efficiency η_T is then given by

$$\eta_t = \frac{E_e}{E_e + P_u} \qquad (5)$$

And, since the kinetic energy in the experimental chamber is equal to the product of the weight flow per unit of time and the velocity head in the experimental chamber; the definition (5) may be written

$$\eta_t = \frac{1}{1 + \dfrac{H_f}{H_e}} \qquad (6)$$

It is readily apparent that, as long as the conditions of flow permit the assumption of constant density throughout the tube, the tube efficiency is independent of speed. Also, since the efficiency of a propeller working at a fixed point is independent of its angular velocity, the same assumption leads to constant fan-tube efficiency. The overall efficiency, however, will usually vary slightly with speed, on account of the variation of the efficiency of the prime mover.

On account of the previous relations established, it will be easily seen that, in addition to (6) the other efficiencies may be expressed in terms of the friction and velocity heads; thus

Fan-tube efficiency:—

$$\eta = \frac{1}{1 + \dfrac{H_f}{H_e \eta_p}} \qquad (7)$$

where η_p is the propeller efficiency.

Overall efficiency:—

$$\eta_o = \frac{1}{1 + \dfrac{H_f}{H_e \eta_p \eta_m}} \qquad (8)$$

The formulas (6), (7) and (8) are in the most practical forms as written, since the various losses throughout the tube, etc. are usually expressed as fractions of the velocity head in the experimental chamber.

Finally, it is noted that since the "energy ratio" of a wind tunnel is usually defined as the quantity

$$R = \frac{E_e}{E_s}$$

the relation between energy ratio and overall efficiency is

$$\eta_o = \frac{R}{1 + R}$$

In the following table, we give the corresponding energy ratios and overall efficiencies of a few well known wind tunnel installations:

Table

Installation	Energy Ratio (R)	Efficiency (η_o)
McCook Field (14 in.)	3.65	78.5%
Bureau of Std's. (3 ft.)	3.04	75.2
Langley Field	1.82	64.5
Eiffel (2m)	1.35	57.5
Mass. Inst. Tech. (4 ft. Venturi type)	1.31	56.7
Gottingen	1.09	51.1
(8 ft. x 8 ft.)	0.88	46.9
(8 ft. x 8 ft.)	0.88	46.9
Curtiss (7 ft.)	0.69	40.8

The Strength and Air Resistance of Tapered Struts

By Edward Adams Richardson

IN number 152 of the Technologic Papers of the Bureau of Standards, an attempt is made to derive equations for the strength of a particular form of tapered strut. The resulting equations are unwieldy, and must be solved by trial and error methods, as no direct solution is possible. Furthermore, the form of presentation of numerical results is such as to lead to the belief that no special benefit would accrue through the use of such struts. To correct this impression and deduce strength equations of the simplest form are the aims of this paper.

First let us derive the equations of strength. We will consider a strut fixed at one end, with axis initially vertical, loaded at the free end by a centrally applied vertical force. Under this loading, the axis of the beam will become curved. We will choose our coördinate axes so that the fixed end of the neutral axis is at the origin, and the initial position of this axis will lie along the X axis. The distance of any point on the deflected position of the neutral axis from the X axis will be "y". The distance of the free end from X will be "a". The load will be "P". The modulus of elasticity of the material will be "E". The moment of inertia of the cross section of the strut at any section will be "I". The simple theory of beams will enable us to write the equation of rate of change in the slope of the neutral axis in terms of these quantities. We obtain,

$$\frac{d^2y}{dx^2} = \frac{P(a-y)}{EI} \qquad (1)$$

In the case of the straight strut, "I" is a constant. If we integrate the above equation for that condition, we obtain the usual Euler strut formula. But we propose to assume that "I" is some function of "x", since our strut will be tapered.

We will find, after some trial, that it is impossible to assume any particular function for "I" which will give a simple integral. In fact, even the simplest types of functions lead to most complex types of integrals. We note, however, that we can integrate easily if we may substitute for the right hand member a function of "x". We may assume that this member is a constant. If we do, it is the same thing as assuming that the moment of inertia of the section is everywhere proportional to the moment of the external forces. We secure in this way a strut of uniform strength.

We shall confine our attention to this particular type of tapered strut. The Bureau of Standards report previously referred to, treats a type where $I=C(l-x)^2$, l being the length of our strut, C a constant.

Integrating the equation below, we have,

$$\frac{d^2y}{dx^2} = k$$

dy

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$$\frac{\quad}{dx} = kx + c_1$$ Since the left member is zero when x is zero, the constant c_1 must be zero.

$$y = \tfrac{1}{2} kx^2 + c_2$$ Since the left member must be zero when x is zero, the constant c_2 muse be zero.

But $P(a-y) = kEI$

Substituting in this equation "a" $= \tfrac{1}{2} kl^2$, and for y the quantity $\tfrac{1}{2}kx^2$, we obtain, $Pk(l^2-x^2) = 2kEI$, or $P(l^2-x^2) = 2EI$

The strength of the strut is, therefore,

$$P = \frac{2EI_0}{l^2}$$ I_0 = Moment of inertia of section at $x = o$.

If we apply this equation to the case of the round ended strut of length $L = 2l$, our equation becomes,

$$P = \frac{8EI_0}{L^2}$$ where I_0 = Moment of inertia of center section.

Euler's equation for the straight strut is the same if we substitute π^2 for 8. Hence we immediately learn that the ratio of the strength of a tapered strut to that of a straight one having the same value of I_0 for the central section, is 8.00/9.87 =0.810.

Before proceeding further, it should be noted that our equations will actually yield round ended columns. We must expect to strengthen the end sections sufficiently to take the direct compression stresses. This will modify our conclusions with regard to resistance and weight, but this correction should not exceed 15 per cent of the differences with which we deal. We shall in any case save somewhat in the size of our fittings, since our strut ends will be smaller, a factor tending in considerable measure to offset the effect of this modification of our theoretical form (as deduced solely on bending moment considerations).

Subject to the limitation imposed, there are a number of ways in which we can vary the value of "I", and each method will yield a different shape of strut. We will consider (A) Solid struts, (B) Struts made of sheet metal of constant thickness, (C) Struts made from straight tubing by hammering, peening, spinning, rolling, or otherwise bulging the tube towards the center, the area of metal cross section being constant along the strut, (D) Struts made by forging or casting, so that all cross sections shall be geometrically similar. In all cases we will assume that the coefficient of fineness is constant throughout the length of the strut. The calculations for the solid strut will be given in full, but only the results will be given in the other cases.

$$I = \frac{P(l^2-x^2)}{2E} \qquad I_0 = \frac{Pl^2}{2E}$$

$$\text{Hence } \frac{I}{I_0} = \frac{l^2-x^2}{l^2}$$

But $I = md^4$ So $d = d_0 \sqrt[4]{(l^2-x^2)/l^2}$

We may easily find that the volume of such a strut, (actual material) is $\pi/4$ that of a straight strut with same center cross section. We find that the ratio of load supported to weight is 1.03 when that for the straight strut is one. Not very large. But we will find that the projected area ratio between the tapered and straight struts is 0.871. We save 22.9 per cent in resistance and lose 19 per cent in strength by tapering a given solid strut.

The above figures are typical of those given in the Bureau of Standards paper. Tapering would seem futile taking them at their face value.

Let us suppose that we keep the resistance of the two struts equal. In this case we can have a central section 1.148 times the diameter of the straight strut. The moment of inertia will be $1.148^4 =$ 1.742 times as great. Our tapered strut has only 0.810 the strength of a straight strut with same central cross section, so our tapered strut has $1.742 \times 0.810 = 1.41$ times the strength of the straight strut of same resistance. The weight ratio is $1.148^2 \times 0.7854 = 1.037$, so the tapered strut is slightly heavier. The tapered strut carries $1.41/1.037 = 1.36$ times as great a load per pound of strut.

These results are most important, and put a very different aspect on the importance of tapered struts. Our table below quotes similar results for hollow struts made on the plans previously outlined. Our first coefficient is the relative weight (to that of a straight strut) for equal loads and equal diameters of central sections. Our second coefficient is the ratio of the projected areas in this case. Our third coefficient keeps the projected area and loads equal, and measures the ratio of weights.

Table I

Type	Coef. 1	Coef. 2	Coef. 3
Straight	1.000	1.000	1.000
B	1.039	0.842	0.677
C	1.235	0.785	0.761
D	0.970	0.871	0.735

It will be seen that we may cut the weight of our struts nearly 30 per cent without increasing the resistance of our machine, simply by properly tapering them. Furthermore, the most suitable type of strut is the one most easily built, the sheet metal affair welded together. We see, further, that we may cut resistance nearly 15 per cent with a weight increase of only 4 per cent.

A discussion of resistance versus weight is too broad for adequate treatment in a short article, but we will, nevertheless, give a few cases to indicate the mode of treatment, and give an idea of the importance under certain conditions of the one or the other. We will use the usual criterion of equivalent weights, although as usually given it is most defective.

Suppose we have an airplane travelling 100 miles per hour, with a power loading of 12 pounds, a typical strut would have $I = td^3$, $A = 6.37$ td, $P = 26{,}000$ pounds, $E = 3 \times 10^7$ $L = 100$ inches, $d_0 = 2.5$ inches. A straight strut would weigh 25.4 pounds, and require 2.12 H. P. to lift it. The power to move it through the air would be approximately, $(0.000204 \times 2.50 \times 100/144 \times 100^2) \times (100 \times 88) \times 1/(0.81 \times 33{,}000)$ =1.17 H. P. Our propeller efficiency is assumed at 0.81. We can afford to increase the resistance to save weight. Yet we can taper our strut without increasing the resistance and save 0.69 H. P.

Next consider a racing machine at 200 miles per hour with a power loading of 4.5. It will take 5.64 H. P. to lift the strut, (assumed as in preceding case), and 9.34 H. P. to move it through the air. In this case we can save 1.82 H. P. by tapering, the air resistance remaining the same. If we tapered, keeping the central diameter the same, we would lose power.

For medium speed commercial machines where economy in power is desirable, and weight lifting is of importance, a small but by no means negligible gain can be secured by proper strut tapering. In racing machines we can economize on power where we have struts by properly tapering. We have not considered the case of struts protected from air resistance but it should be apparent a considerable taper may be used with advantage to reduce weight, since the larger the center section, the less the material needed to secure a given moment of inertia.

Is The Liberty Engine "Obsolescent"?

By L. D. Seymour

THE great aircraft engine designed by America's foremost engineers, developed and given to the military and naval forces of the United States in 1918 by the Army Air Service has neither been forgotten nor abandoned by the Army since the signing of the Armistice. With a large number of the engines available for future use at the close of the war, the Army has spared no effort to continue the unexcelled record of the Liberty.

Resulting from service use and exhaustive tests many refinements have been added and changes made. As new features of design or modification have proven of value, they have been incorporated in the engines in the possession of the Service and given not only to other branches including the Navy Department, but prominent manufacturers and designers for the general advancement of the art of aerial navigation.

While the characteristics of this engine are fairly well known to those connected with the Air Service, it may be found of value to recite some of the outstanding features for those not so intimate with aircraft. As originally designed with a weight of only 800 pounds, a horsepower of 400 was secured with the propeller shaft turning at approximately 1700 revolutions per minute. Two complete ignition systems were installed to guard against the possibility of trouble in the air from that source. Two duplex carbureters were used each divided into two units serving three of the twelve cylinders. Practically four separate carbureters were thus employed, but so set, adjusted and controlled that each cylinder

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would receive the same quality and quantity of fuel. A most interesting point in connection with the water system is the circulating pump. This pump though of the small centrifugal type is capable of delivering 100 gallons of water per minute with a free outlet. With the foregoing in view it is the more wonderful when compared with the ponderous proportions of even the lightest of steam powerplants installed in electric generating stations where even only a fraction of 400 horsepower is delivered. Not content with these characteristics, however, a constant effort has been made toward greater development with very gratifying results.

It is interesting to note some of the changes that have added immeasurably to the usefulness of an already marvelous powerplant.

In the following paragraphs note has been made of a few only of the changes which have occurred and the reasons therefor. From these one will be able to form an opinion of the work that has been done and what a part of the peace time duties of Uncle Sam's Air Service include.

The Problem of Lubrication

In an aircraft engine all working parts are usually lubricated by a direct oil lead carrying oil under pressure. Even though every means possible is employed to hold this pressure at the right value sometimes too much oil reaches the piston wall. This in the ordinary engine results in oil passing the piston, fouling spark plugs, forming carbon in the combustion chamber, hindering the proper operation of the valves, causing overheating, pre-ignition, etc. So that such a possibility might be reduced to a minimum, four small holes were drilled in the oil pressure relief valve giving an almost perfect balance to the oiling system at all speeds.

As an extra precaution, the pistons have been grooved and drilled so that excess oil is collected and drained back into the crank case or "sump" before it has had a chance of getting to the combustion chamber.

One of the greatest triumphs of McCook Field has been the development of a centrifugal oil cleaner. It has long been the practice of the Air Service to reclaim oil which has been used until impurities such as sediment, etc., have been collected, rendering it useless. This process while resulting in purification to the extent that the oil is of a better quality than the original, requires large tanks, heaters, etc., the weight of which runs into hundreds of pounds. It remained for Air Service engineers to develop the new centrifugal cleaner which is hardly bigger than one's two fists. This cleaner is made an integral part of the engine removing impurities of all kinds from the oil as fast as they are collected. This not only makes it simply necessary to add the oil that is actually consumed but makes draining and washing of the oil system a thing of the past.

Not only the engineer, but any layman can easily appreciate the importance of advantages accruing from these various devices such as: certain, constant, uniform oiling with never a "feast or a famine"; unheard of economy; prevention of carbon formation, cleaning seldom required and overheating from this source unknown.

Fuel System and Fire Hazard

Naturally, in the air, fire is a greater danger than in almost any other place. For this reason no effort has been spared to reduce the chances of a fire starting from the power plant. The difficulties incident are very apparent when it is remembered that a 400 horse power motor must be supported in the light frame of an airplane.

To this end flexible fuel line connections impervious to vibration have been developed. Carbureter air intake pipes where once gasoline vapor condensed and dripped back onto the engine have been led outside and above the engine housing to prevent the collection of gasoline where it could be ignited and cause damage.

By ingenious means and devices the engine's carbureters have been so changed that the gasoline consumption has been reduced approaching one half the former amount. At the same time a much better proportion of gas and air have been secured which gives increased smoothness of operation, flexibility and complete combustion. One of the greatest advantages secured by these changes is the greater range of altitudes at which uniform operation is possible.

Probably the greatest cause of fires in the past has been the fact that gasoline was led to the carbureters under air pressure which, if a leak in the system occurred, caused the entire power plant, etc., to be subjected to a fine spray of fuel. This of course, mixed with air, forms one of the most inflammable mixtures known. All this has been changed now with the successful development of a mechanically operated fuel pump supplying gasoline to the carbureter without the use of pressure in the tanks.

It is a well known fact that due to the rarification of the air at great heights, an internal combustion engine is able to deliver only a small fraction of its sea-level power. The supercharger, another newly developed accessory for the Liberty removes this difficulty by delivering to the engine, at any explored altitude, air substantially the same as at sea level.

The Electric System

Even though other parts and devices of any aircraft engine may be perfect the fact remains that the electric spark which fires the charge must be delivered at all times if there is to be any operation at all. In order to insure this many changes and modifications have appeared to guarantee non-failure from this source. Among other important items in redesign and reconstruction are the following: A 12 volt system has been substituted for the 8 volt, in addition allowing the employment of a self-starter; storage battery improvements; addition of buzzer distributor starters, safety relays, etc.; more completely armored cables and positive connections.

In other small features a recitation including redesigned flexible shafts, larger bearings, stronger gears, water system improvements, etc., could go on for many pages. However, those enumerated serve to show the untiring efforts that are constantly being exerted to keep the greatest war time engine also the greatest in peace. No attempt has been made to keep secret these discoveries which have added so much to our knowledge of engine construction in general, but rather they have been carefully explained and given to all interested in the progress of aeronautics including the Navy, Marine Corps, commercial concerns, etc. This attitude and action of the Army Air Service shows the value of this special research and will go a long way toward the development of the art in general. By such unselfish and patriotic endeavor will aerial navigation the sooner take its proper place in this country as the best means of transportation and communication. More than this the same American spirit is shown to be alive that first gave to the world a practical solution of the problem of flight.

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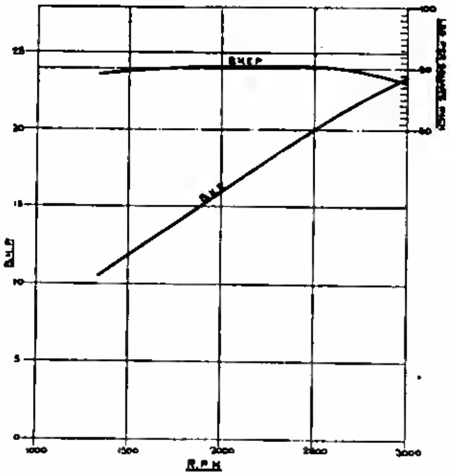
The "Bristol" Cherub Flat Twin Aero Engine

THE growing interest in aircraft of the glider type equipped with an engine of comparatively low horse-power has been carefully watched by the Bristol Aeroplane Co., Ltd., and for the past fifteen months their aero engine department has been developing and perfecting a small 1070 c. c. flat twin air-cooled aircraft unit suitable for this purpose. The unrivalled experience which they have gained with their eminently successful and widely known 400 h. p. Jupiter and 100 h. p. Lucifer air-cooled engines has assisted in the production of a smaller type, soundly constructed and of the greatest reliability.

Twelve or fourteen years ago aircraft pilots were seriously handicapped by the limitations and failures of the small powered engines then in use. Engines of converted motor cycle type—as most of them were—they were probably quite satisfactory on the road when they were rarely run for more than a minute at full throttle, but for aircraft units they were unreliable, and therefore useless. In the development of their new type, the Bristol Company have insisted upon sound reliability and have produced an extremely robust power unit. The new engine has been subjected to exhaustive experiments on the Froude test bench under conditions exactly similar to those demanded by the Air Ministry for large aero engines, and continuous ten hour non-stop power tests have been carried out on the Froude dynamometer.

Two types of engines have been designed—one with driving boss running at crankshaft speed, to be used in conjunction with a chain-driven propeller, and the other with a 2 to 1 gear reduction enclosed in the crankcase.

In this very sturdy little engine all the valve mechanism is entirely enclosed, ball and roller bearings are used throughout, and the lubrication is entirely automatic. This engine can be left to run for long periods at full rated power, without any attention or adjustment—special measures (which are described later in detail) having been taken to deal with the attendant troubles usual with overhead valve air-cooled engines.



Power curve of the Bristol Cherub

The following are the main details of the engine:—

2 cylinders horizontally opposed.

Bore	85 m/m.
Stroke	94 m/m.
R. A. C. Rating	8.95 BHP.
Rated H. P.	18 at 2,500 RPM.
Weight of Engine Complete	85 lbs.
Petrol Consumption per hour,	12 Pints.
Oil Consumption per hour,	½ Pint

From the illustrations of the engine its clean appearance will be noted, and also the fact that there are no exposed moving parts to lubricate, wear, or require adjustment.

The cylinder construction calls for attention as the head is detachable, and of aluminium alloy, the sparking plug bosses being bushed in bronze.

The valve mechanism is of special interest. A single camshaft with four integral cams, and driven by very robust gearing from the crankshaft, lies inside the crankcase. The cams operate fingers, which in turn operate rocking shafts enclosed in tubes; the rocking shafts are returned by coiled springs, and the mechanism is such that when the cylinders warm up there is no increased clearance between the rocking shafts and valves. Twin concentric springs are used for the Tungsten valves. The whole mechanism is enclosed and automatically lubricated; thus remaining quiet, wear does not take place, and frequent adjustment is not necessary.

The crankshaft is very stiff and robust, and is supported on three ball bearings with thrust bearing.

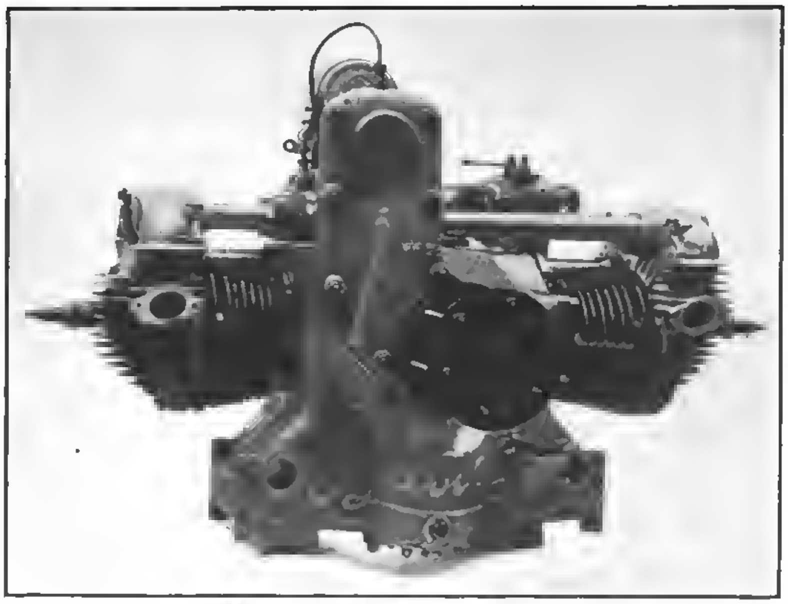
The connecting rods are threaded on to the crankshaft, and run on case-hardened crankpins with 7/16 inch rollers. The big end of the connecting rod has a case-hardened bush inserted. The whole crankshaft and con rod assembly is of very ample proportions, and special attention has been given to the connecting rod roller bearing assembly, so that very long life can be guaranteed under continuous working conditions.

The crankcase is a one-piece casting, arranged at the rear end with a large aperture, which provides for the connecting rod assembly being inserted complete.

Lubrication of the engine throughout is automatic. Oil is positively delivered to the timing gears, camshaft, rocker mechanism etc. and pressure feed is directed on to the connecting rod assembly, from which the cylinders are lubricated by "splash". The necessary lubricant, approximately 1-gallon, is carried in the sump provided in the lower part of the crankcase, which floods the plunger pump. A convenient oil-filler and filter are provided.

Ignition is by B. T. H. twin cylinder Magneto, driven by gearing from the crankshaft.

(Concluded on page 181)



The Bristol Cherub Flat Twin Aero Engine

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What is the Matter with Commercial Aviation?

By William Knight, M. E.

IN 1919, Henry Bouché published in "L'Europe Nouvelle" an article under the title "The Government and the aeronautical industry" in which he said: "During the war the differentiation of aircraft and flying equipment has become more and more pronounced and has given rise to aircraft particularly adapted to a number of special services required of them, such as: day bombardment, night bombardment, escort for day and escort for night bombardment, observation, regulation of artillery range, infantry liaison, long distance reconnaissance, night reconnaissance, chase, chase at great altitude, night chase, patrol, coast line patrol, escort for convoys, etc., and all of these specialized services were the outcome of present day war requirements and, as such, were the outcome of the tactics of the great war, which will not necessarily be the same in another war.

Who can anticipate what will be the tactical requirements of another war in so far as aeronautics is concerned? Have we not learned during the last war that war tactics are formulated and modified at every instant according to the needs of the hour? If this is the case, we have no assurance at all that in another war we shall be able to utilize our present stock of aircraft and it would be dangerous for us to live under any such delusion."

I think that these remarks made by Henry Bouché a few months after the armistice were quite to the point and pointed out at that time a program of governmental aeronautical policies which after four years of aeronautical developments in Europe under Government control, defines just as clearly today as it was the case four years ago, the proper order of relation between the Government and the Aeronautical Industry which should have prevailed in Europe and in this country at all times during the last four years. At any rate, in so far as we are concerned, the last four years of operation of commercial aviation in Europe under the regime of government subsidies should teach us a good lesson.

The lesson that we must learn is this: To impose upon commercial aviation developments (design of aircraft, choice and operation of air lines, location of airdromes, etc.,) as a condition for obtaining a Government subsidy, restrictions aiming at an eventual mobilization of aircraft and aerial lines in case of war, is an error.

It is not in accordance with the best interests of any nation to create an aircraft manufacturing industry working almost exclusively on government orders and designing aircraft either frankly intended for military uses or else capable of being rapidly transformed into military aircraft in time of war.

This is detrimental to the interests of commercial aviation which has problems of its own, having very few points of contact with the problems arising from military and naval aeronautical tactics which must necessarily change more or less rapidly in time of peace and sometimes very rapidly in time of war.

Adverse Conditions That Aircraft Manufacturers Have to Compete With.

Commercial aeronautics instead, in order to be able to live a healthy business life must possess a character of permanency which is not possessed by military aeronautics and, for this reason, it must develop standard types of aircraft well adapted to the particular service that they are intended to perform (now and not in time of war) and must be able to produce a sufficiently large number of such aircraft in a minimum time and at a minimum cost.

As long as aircraft manufacturers are working almost exclusively on Government orders, according to government specification, and are building only a few aircraft of the same model, as it must necessarily be the case when building aircraft adapted to the ever changing requirements of the Army and the Navy, the manufacture of aircraft cannot be placed on a production basis, standardization of parts cannot be accomplished, the price of production must remain high and no aircraft manufacturer can afford to maintain a technical staff of engineers and designers always on the lookout for improvements in design and methods of manufacture leading to lower cost of production and more efficient operation of aircraft.

In this country where commercial aviation activities, with the exception of the Aeromarine Airways Co., and the U. S. Air Mail Service, are today almost at the same point where they were three years ago, commercial aviation offers no important market to aircraft manufacturers. The absence of a sufficiently large market for commercial aircraft, quite evidently, does not encourage aircraft manufacturers to design and to build commercial aircraft, especially not knowing what the demand for such machines is going to be when we will start commercial aviation activities. Shall the greater bulk of the demand be for passenger or else for freight carrying machines? Large machines or else small machines shall be most popular with aerial operating companies tomorrow?

These and a dozen more questions confront an aircraft manufacturer today who feels ambitious enough to design and to build a purely commercial aircraft for which there is no demand and that when it is finished costs so much that it cannot be sold. The result is that when once in a long while one of the so-called commercial aircraft are produced, they are more or less of a bad adaptation of a good type of military aircraft to commercial service, representing the best that could be done by the designer under the circumstances.

In other words, an aircraft manufacturer who does not feel justified in putting a good deal of money in the design and construction of an efficient type of commercial aircraft answering the requirements of a non-existent aerial operating company, (that he will have to guess about) simply makes the best possible adaptation of a military or naval type of aircraft, calls it a commercial aircraft and let it go at that.

Under such conditions as are prevailing at the present time, it would be hardly fair to blame aircraft manufacturers for failing to produce the types of aircraft that will make it possible to operate aerial lines on a paying basis. After all aircraft manufacturers are in the business for the purpose of making and not losing money and, if their only good customer today is the Government, a customer that knows exactly what he wants and is ready to give every engineering assistance to the manufacturer, why should aircraft manufacturers design and build at their own expenses and at their own risk commercial aircraft for which nobody knows the chief service for which they will be used when they will be needed?

Aeronautical Engineers, designers, experts on every branch of aviation, pilots, mechanics, skillful workers that have been trained during the war at a tremendously high cost have dropped out of aeronautics where no demand exists for their services. We will need them again in the future but most of them will not be available any longer and a large percentage of those available will have lost a good deal of their efficiency anyway, while others yet will be of little value when the time comes because they could not keep up with the progress that has been made in aeronautics during the last four years.

Aeronautical Engineers, designers and experts who could not find a job with the Government or else who could not afford to work for the Government on a pitiful government salary, have been absorbed in other branches of the industry and those who are working at present in the aircraft manufacturing industry are not supposed to have or to use much inventive ability, their job being to build military aircraft according to government specifications.

The Government is Doing the Work That Should be Done by the Industry.

Development research and experimental work which is the foundation upon which is built up the efficiency of any engineering and manufacturing enterprise, is in the hands of the government and is conducted in huge and costly engineering organizations run by the Government. The result of these prevailing conditions is that instead of training a competent staff of engineers and technicians in every aircraft manufacturing plant and depending on their ability and resourcefulness for developing new types of machines that will do the trick required of them and will pay dividends to the stockholders of the company that they are working for, we are developing a number of governmental aeronautical experts.

Are we best serving the interests of the nation by centralizing in the hands of the Government development and experimental work that could be performed by our aircraft manufacturing industry, especially at the present stage of development of commercial aviation? I do not think we are.

It seems to me that we are not so much interested in designing and building military and naval aircraft, as we are interested in building up a well balanced aircraft manufacturing industry capable of turning out to-morrow, in case of war, a large number of any desired type of aircraft which will be required at that time and at such low prices as it is possible to obtain only when standard manufacturing methods of production, standardization and interchangeability of parts have been developed by the Aeronautical Industry in peace time.

We all know that a modern war is a war of intensive industrial production requiring the services of armies of specialized workers in every branch of production, just as much (if not more) as armies of soldiers. We can safely predict that the next war (if there is going to be another great war) will be fought in the air and will be won by the nation that shall be able to win the supremacy in the air at the outset and shall be able to maintain it up to the end.

Quite evidently this object can be ob-

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tained only by the nation possessing the best organized aircraft manufacturing industry and the largest number of well trained flying personnel and not, by any means, by the nation possessing the largest military and naval air forces and a poorly organized aircraft manufacturing industry, when the war starts.

However this is the road that we have been travelling on since 1919 both in this country and in Europe. France has today the largest number of aircraft possessed by any nation in the world and has the largest number of aerial lines operated mostly by inefficient commercial aircraft (which however, in case of war can be rapidly transformed into military aircraft). Both the construction of aircraft and the operation of aerial lines (which have been selected in many cases for political reasons only, without any reference to climacteric conditions prevailing during a large part of the year and without any reference to the business available along the line) is costing the nation every year hundreds of millions of francs paid to aircraft manufacturers for building military aircraft camouflaged as commercial aircraft and for making good the losses of aerial operating companies which after four years of operation are unable yet to pay a fraction of their operating expenses.

On the other hand, in spite of the fine display of aeronautical activities in France and elsewhere in Europe, we must acknowledge the fact that neither France nor any other country has made any decided progress in scientific research work in aeronautics since the war, with the exception of the United States and Germany.

Why Germany Can Lead the World in Aeronautical Developments

It is painful to have to acknowledge it, but it is true just the same, that, of all nations, Germany is the only one that, if political and economical obstacles were removed at once, which are now preventing that nation from taking its place in the aeronautical field, inside of a very short time would lead the world in aeronautics.

Why is it so? Because Germany has kept together a nucleous of aeronautical Engineers, experts and specialists trained at the school of the war and, since the war, while other nations were building aircraft that in a near future will have to be thrown on the scrap pile. Germany has kept scientists and technical men busy at work solving the many complicated problems that must be solved in the selection of manufacturing methods in the use of aircraft materials and in the design and construction of aircraft, power plants and instruments that will make possible to operate aircraft in time of peace as a safe and efficient means of transportation and that, in time of war, will allow of a rapid industrial turn-over of aircraft and aerial equipment as it is needed.

We have seen in the late war that the great superiority of Germany in the first three years of the war was neither due to better tactical methods adopted by its generals (in fact the greatest tactical blunders were made by German Generals right at the outset of the war) nor to the superior military training of German soldiers. The great superiority of Germany over the allies was its magnificent industrial organization.

In every important plant in Germany that during the war was turning out aeronautical material, we find today a change in the production but we find in the shops the same foremen and as large a percentage of working personnel as it has been possible to retain under the changed production conditions. We find an aeronautical engineering bureau and an aeronautical research laboratory, and, judging by the activity of the work going on there you would not think that Germany has lost its wings.

Scattered all over the country we find attached to universities and technical schools a number of very important scientific research organizations working in close coöperation with former aircraft manufacturers. The German Aero Club, The Society of Aeronautical Engineers, The Aircraft Manufacturers Association and the Aero-Lloyd A. G., (this last being the world's most powerful combination of steamship lines, manufacturing organizations and financial interests backing an apparently inexistent aeronautical organization) closely coöperate with each other and with scientific research organizations, and are preparing the industrial machinery that will insure to Germany the dominion of the air in Europe, one year after the present obstacles are removed which are now preventing Germany from claiming its own place in the aeronautical field.

Aeronautical Governmental organizations, like the one at Adlershof that during the war was one of the most important centers of aeronautical engineering activities in Germany, are now all closed down and, for every practical purpose, the German Governmental aeronautical machine is shattered to pieces. Has this shattered to pieces aeronautics in Germany? Not by any means—in fact, aeronautics is much more alive today in the plans of the captains of German industry, in the Engineering bureaus and in the research laboratories attached to German manufacturing plants and educational institutions than it ever was in any other country, including our own, where the governmental machinery has remained intact and the aeronautical manufacturing organization has been shattered to pieces, and where the great bulk of business men have failed to realize yet the unlimited commercial possibilities of aeronautics.

What We Need Most is a Prosperous Well Balanced Aircraft Manufacturing Industry

As I said before, the interests of the nation are best served by encouraging in every possible way the development of commercial aviation in this country. In the meantime, however, we must realize that the foundation of commercial aviation is the commercial aircraft and we must direct all our efforts to the production of aircraft, power plants and instruments which will make possible to operate aerial lines as a paying proposition.

For this we need laws and regulation, this is understood, but we need most and primarily an aircraft manufacturing industry that will look upon aviation as a transportation service and not as a source of government jobs.

Military and naval aircraft bear the same relation to commercial aviation that battleships bear to the merchant marine. It would be an error to subsidize privately owned shipbuilding plants for turning out inefficient steamships for the purpose of being able to transform them in time of war into battleships.

The remark might be made here that it would be equally an error to depend on builders of merchant ships for turning out battleships in time of war. This is true, but the same criterion cannot be applied to the aircraft manufacturing industry. If our aircraft manufacturing industry is well organized for turning out in peace time standard types of commercial aircraft, in time of war it will be perfectly capable of turning out any desired number of military aircraft with some slight adjustments in its organization.

In the meantime what shall we do while we have no standard types of commercial aircraft and no market for such a thing? Shall we wait until Germany is in a position to sell to us at a low price good commercial aircraft, thus greatly injuring our own aircraft manufacturing industry? Shall we expect from our aircraft manufacturers to develop standard types of commercial aircraft and finance themselves the operation of a few aerial lines thus proving to the public that aerial navigation is both safe and practical? Shall we expect the public at large to invest their savings in aerial securities when we know that none of the aerial operating companies now in existence is paying its operating expenses?

I do not think that we can do much for solving all at once the various problems that commercial aeronautics is facing at the present time. All we can do is to recognize what we need and work in the right direction with the means at our disposal today. The main needs of today are: a federal aeronautical legislation, capitals, good commercial aircraft, and a well trained aeronautical personnel.

In so far as aeronautical legislation is concerned we are led to believe that we will soon see the beginning of some sort of action in the direction of establishing a Bureau of Aeronautics under the Department of Commerce which will make possible to submit to congress in a not too far distant future, a plan of legislation, which, we hope, will act as a spur and not as a brake on individual initiative. Let us keep in mind however, when framing any aeronautical legislation that will be submitted to Congress for approval that, up to a certain limit, government control is a necessity for doing business, and, behind that limit, government control is the surest way for paralyzing business. I think that Government control as applied to our railroads during and after the war and our recent attempts at government control of our merchant marine will admirably serve us for determining the critical point when government control ceases to be a blessing and becomes a curse.

We Need an Air Mail Service Operated by Aerial Operating Companies

To find out what the people want and to find out what is needed by business men, municipal and state governments in the matter of legislation in aeronautics is one of the most important functions that the National Aeronautic Association of the U. S. A. will have to perform. As long as this Association will be independent of any predominant influence exerted by either the Army, the Navy, Aircraft Manufacturers, politicians, financiers, pious or any other class of people or group of interests bent upon having commercial aviation in this country shaped according to their own pet idea of how it should be done, the National Aeronautic Association of the U. S. A. will be the connecting link between well balanced commercial, political and military interests in aeronautics and will be in a position to bring about the enactment of aeronautical legislation and the adoption of aeronautical policies by the government which will best serve the interests of the nation.

To lose sight of this most important function of the National Aeronautic Asso-

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ciation would be a great error. To cater to any particular class or group or to be lead at any time by any particular group of people or interests to the adoption of a line of conduct by the Association which would bind it to the furtherance of the interests of any particular group would be the surest way to destroy the great prestige that has been gained in a few months by the Association, through the annunciation of a very broad and most comprehensive program of activities of which the keynote has been:—"Service to all."

Once we have adopted federal laws and regulations which will make possible to organize aerial operating companies and to fly all over the country under known uniform restrictions and uniform guarantees equally protecting the interests of both the public and the operating companies, capital will be attracted to commercial aeronautics in proportion of the present and future possibilities offered by aeronautics as a field of investment.

Like any other field of investment, aeronautics will not be able to win the interest of the public unless it has something real to sell. This something real and tangible can be offered only at the present time by the transportation of mail and parcels under contracts secured by prospective operating companies from the Government and express companies.

Quite evidently this is the point where the Government can and must help developing aviation. Contracts to properly organized aerial operating companies for the transportation of mail will have to be awarded under conditions which will encourage the establishment of aerial lines along routes where aircraft can successfully compete with other means of transportation. The transportation of mail and the guaranty of a minimum load should be granted by the Post Office Department to aerial operating companies only as a temporary measure for extending the help of the Government to such companies, which, due to the future transportation possibilities (of both passengers and merchandise) offered by the territory over which they intend to operate, and due to the type of aircraft intended to be used and the kind of terminal facilities secured by such companies, should be temporarily helped by the guaranty of a minimum volume of business enabling them to shift for themselves, with or without a government contract, in a few years time.

In other words, contracts to aerial operating companies for the transportation of mail should be granted not so much with a view of creating permanent air mail routes on lines where such service is needed as with a view of helping create commercial aerial lines for the transportation of passengers and merchandise wherever this method of transportation, in competition with or supplementing other means of transportation, offers a promising field of commercial activities, even if an aerial mail route is not a very desirable one at the time when operation starts.

Commercial Aviation and Subsidies

This, it might be pointed out, is a way of subsidizing commercial aviation, same as it is subsidized in Europe. To a limited extent this is true, although there is a fundamental difference between subsidizing aerial companies operating along lines which are not and will never be a field of revenue, (as it is done in Europe in a good many cases, for political and military consideration) and subsidizing commercial lines in this country along lines which are strictly commercial.

Besides this the guaranty of a minimum load of mail matter to American aerial operating companies does not need to be a subsidy. If a contract is granted to a company for the transportation of mail along a line where enough to make up the minimum load contracted for can be obtained, this is not a subsidy but is a payment for service rendered.

If a contract is granted to a company operating along a line where there is not enough postal traffic to complete the minimum load contracted for, it might be easily arranged that the difference between what represents payment for services actually rendered and the total amount paid by the Post Office Department would be reimbursed to the Government by the municipalities or the states being directly benefited by the establishment of aerial lines out of municipal or State taxes paid by the operating companies at such time when these companies will be on a self-paying basis.

The great weakness of the subsidy system in Europe is that it does not act as a stimulant to ever increasing independent business activities on the part of aerial operating companies, but it rather acts as a premium paid to them for abdicating their business judgment in favor of the political and military judgment of the government. The aircraft used are not the best adapted to the kind of service required of them, although they are entirely satisfactory to the Air Service (of France, for instance which pays 50% of the cost of aircraft and the balance of the unearned cost of operation of air lines amounting to between 80 and 90% of the total, according to figures recently published, covering the first eight months of 1922). There is entirely too much paternalism, too much Government control in aeronautics in Europe. Too much politics and too much militarism are mixed up with commercial aviation in Europe and this is the reason why aerial lines are yet unable to pay more than a fraction of their operating expenses after four years operation.

Under these conditions we fail to see where is the great superiority of Europe over the United States in the operating end of commercial aviation. We fail to see what is being done in Europe that we could not duplicate in a few months' time, provided that we were ready to throw away millions of dollars contributed by the taxpayers for the satisfaction of pointing out to a map of the United States crossed all over by black and red lines same as we see published every month in European Aeronautical Magazines. We have not much to show in commercial aeronautics, but what we have is fairly good. We have an aerial Mail Service operated by the Government which in 1922 has flown 1,755,556 miles, has transported 1,512,197 lbs. of mail and has cost us $1,421,419.08 to operate. It is not a wonderful performance by any means in a strictly business sense, but it is the best, the cheapest, the largest and the safest attempt to commercial operation of aircraft in the world at the present time.

What Aircraft Manufacturers Have Failed to Do

If however we can boast of our ability to transport the mail through the air at 6 cents per ounce actual cost of operation, during 1922, (which will be materially reduced when we will use better aircraft flying day and night) we must admit that besides producing some fine types of military aircraft, we have made very little progress during the last four years in the design and construction of commercial aircraft.

This is not surprising when we consider that out of $18,400,000 spent by the Army Air Service, during the fiscal year of 1922 only $5,233,634 went to the aircraft manufacturing industry for purchasing new aircraft, engines and accessories, while $8,300,000 were spent by the Army for expenses of civilian personnel, experimental and research work.

As I said before, we cannot expect aircraft manufacturers in this country to design commercial aircraft (for which there is no demand) out of the benefits of their government contracts; especially so when we consider the fact that, due to the small volume of business secured from the Army and the Navy, they cannot afford to maintain a sufficiently large engineering staff and can hardly do any amount of research and development work. As a matter of fact in a good many cases, due to a miscalculation of the cost of production and other reasons, a government contract has been the source of heavy losses to some of our aircraft manufacturers, which would have been avoided if they had been able to maintain an efficient engineering department.

On the other hand, however, we must admit that our aircraft manufacturing industry in general has taken a very mild interest in commercial aviation; has not done much to change the present situation and, therefore, in failing to help aerial operating companies to get started in this country, it has failed to help itself out of the present situation.

To put over commercial aviation in the United States is a matter of organization of efforts on the part of the Government, financial and commercial interests and the aircraft manufacturing industry. It is also a matter of salesmanship, because commercial aviation finally must be sold to the public.

The Press, and especially the aeronautical press, has quite an important part to perform in coordinating the work required for establishing commercial aviation on a sound business basis in this country. The aeronautical press is the logical medium through which manufacturers, aeronautical engineers, technical men, pilots and mechanics must be kept informed about the progress of aeronautics throughout the world. The aeronautical press must be able to convey to business men exact data and information about aeronautical possibilities and limitations arising from the operation of aircraft, and finally, the aeronautical press is the agency that must ultimately sell aeronautics to the public.

Aircraft manufacturers, in my estimation, have not given to the aeronautical press the support and the collaboration which it was fair to expect of them—this work has been carried on so far by publishers and editors of aeronautical magazines for the love of the game only, which is not fair. There is a great deal of educational and organization work to be performed yet in aeronautics and on a much broader scale than it is done at present by the aeronautical press. Publishers and editors of aeronautical magazines are ready to continue doing their share to the best of their ability: they have a right, however, to request that the aircraft manufacturing industry in this country take a greater share of responsibility in the maintenance and the development of the aeronautical press.

Another point on which aircraft manufacturers have partially failed to contribute their share to the development of civil aviation is in the matter of establishment of flying schools and in the organization of joy rides for the public at large at

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such prices that would encourage any young men to become fliers. The charges made for this sort of series in most of the few places where it can be obtained at present is entirely too high and cannot be justified in the name of business efficiency. I understand that engineers, designers and other technical employees of aircraft manufacturers who are running a flying school must pay for being instructed in the art of flying—most of them cannot afford to do it and consequently, are prevented from acquiring a much needed, more intimate knowledge of machines that they have to design and construct. If this is true, it looks to me like a rather cheap policy.

Also, the Aeronautical Chamber of Commerce, which was organized one year ago and the newly organized National Aeronautic Association of the U. S. A. offer to aircraft manufacturers two very efficient means for furthering the interests of commercial aviation. Both of them, however, in order to be able to do good work must depend on the most earnest cooperation, financial and otherwise, of aircraft manufacturers.

In conclusion, I think that our aircraft manufacturers do not deserve to be blamed for having failed so far to develop standard types of commercial aircraft for the specialized commercial aviation services which will be required in this country. They do deserve, however, to be blamed for having failed to do much in the last four years for removing the causes which are hindering commercial aviation activities in this country—they have been, generally speaking, (with a few exceptions) satisfied with large and small government contracts, without seeming to have much faith in commercial aviation. Their stand on the matter of commercial aviation during the last four years has been just about this: "If the public and the government want commercial aviation in the United States, let them get busy and organize aerial transportation services and we will sell aircraft to whoever wants them and has the cash to pay for them. Of course we cannot sell them as cheap or as good as some foreign countries (Germany, for instance) but both the government and the public will have to pay the price for establishing a manufacturing industry which is essential to the national defense."

Need for Research and Development Work in Manufacturing Plants.

And it is quite true that our national defense depends to a very far extent on the establishment of a powerful, efficient and well organized aircraft manufacturing industry, and not on any number of military and naval aircraft that we might build in peace time. At the present time when the Government is practically the only customer of our aircraft manufacturing industry, the policy should be adopted of reducing to a very minimum the engineering, development and manufacturing work in aeronautics which is done now in Bureaus and plants owned and operated by the Government.

Really there is no need for such work being done by the Government and there is every need for turning this work over to the aeronautical industry that needs money and experience. Of course there is a certain amount of work of a purely military nature which must be secretly done by the Government. But where no military secrets are involved there is no reason why this work could not be performed by the industry.

Purely scientific research work such as is done by the National Advisory Committee for Aeronautics and other Governmental agencies is better performed under Government control rather than under the control of aircraft manufacturers. This however, does not mean that all scientific work should be performed by the National Advisory Committee for Aeronautics. On the contrary it would be very much desirable to have an aeronautical research laboratory built at every important aircraft manufacturing plant. It would be a good plan to appropriate enough money for scientific research work (about ten times the present appropriation of the National Advisory Committee) and authorize the Committee to build wind tunnels and other testing equipment right in the plants of aircraft manufacturers.

Aircraft manufacturers would pay for the ground and for the running expenses of the laboratories where scientific research work would be done under the supervision of the Committee. In this way we would secure a much needed unity of program in aeronautical research work, which at the present time is done in a dozen laboratories working independently one from the other, and at the same time we would educate aircraft manufacturers and aeronautical engineers to the importance and the practical meaning of scientific research work—and God knows that they need badly to be educated along this line.

The same criterion applies to research and development work of instruments and power plants for aircraft which is now being done by the National Advisory Committee for Aeronautics, the Army, the Navy and the Bureau of Standards and which could be very well done by the industry under the supervision of the National Advisory Committee for Aeronautics.

In other words what we need in scientific research work in aeronautics is an organization exclusively in charge of this work which will act as the clearing house of all demand for this kind of work, from every department of the Government and from every branch of the industry that will apply to this organization; the actual work being done in the various laboratories operated by the aeronautical industry under the general supervision of the Government.

The Government Should Not Compete With the Aeronautic Press.

As a matter of fact, scientific research work is not the only field of Government activities where the need is felt of a more businesslike organization of government services and less government management of activities which are better performed by the industry. Before the war this policy was the keynote of our democratic form of government. However, since we went to war against Prussianism, somehow we have become infected with the disease.

In aeronautics, what we certainly need is the elimination of a good deal of unnecessary overlapping and duplication of efforts in the various departments interested in aeronautics and the elimination of a good many governmental organizations which are performing a service that could be more efficiently performed by the aeronautical industry, under the general supervision of the Government. In other words we need to start a centripetal movement of unification of aeronautical services scattered into three or four Departments and Committees and a centrifugal movement of reorganization which will throw out of the Government every aeronautical service that can be absorbed by the national industry. Let us keep in mind that our aeronautical problem is one affecting both the national defense and the industry of the nation at the same time and that we cannot separate these two aspects of a problem that is essentially one.

The publishing business is another field of aeronautical activities where the cooperation of the Government is needed and where the competition by the Government is very undesirable and quite unnecessary. Aeronautical bulletins, reports and other publications which are now edited by the Army, the Navy and the National Advisory Committee for Aeronautics (the latter only spent $35,825 during the fiscal year 1922 for editing reports and technical notes) could be very well edited by the aeronautical press for the same amount of money that is now spent for editing them as special publications of various aeronautical departments of the Government.

The present circulation of these reports is necessarily limited and only some of them are reprinted by aeronautical magazines reaching the public at large. Would it not be better in the interest of aeronautics to publish in aeronautical magazines all non confidential aeronautical reports and bulletins now edited by the National Advisory Committee for Aeronautics and other departments of the Government?

A move such as this, besides increasing the usefulness of government publications would also increase the circulation (and consequently the volume of advertising business) of aeronautical magazines and would enable publishers and editors of these magazines to do more for aeronautics than they are doing at the present.

The National Aeronautic Association Should Take Up the Matters of Standardization.

In the meantime however, let us do two things that we need most at the present time: let us develop our present Air Mail Service (always with a view of decentralizing this service as soon as possible and let aerial operating companies take care of it) and let us tackle the problem of Standardization of parts entering into the construction of aircraft, insofar as it is possible at the present time.

There are a number of parts entering in the design of present day aircraft and aero engines which do not need to be a special job for any new type which is designed, and a good many others, with little effort made in a spirit of cordial cooperation between those interested in this matter, could be standardized for the time being.

In this matter, everybody is interested and every organization interested in aeronautics is doing something in the right direction. The only trouble is that there is not one single organization that is making its business to coordinate the work of all and get some sort of action acceptable to all.

This, it seems to me, is another job and a mighty important one that should be tackled by the National Aeronautic Association of the U. S. A. which for this purpose should invite the cooperation of the National Advisory Committee for Aeronautics, the Aircraft Manufacturers Association, the American Society of Automotive Engineers and the American Society of Mechanical Engineers, in formulating a

(Concluded on page 185)

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Airway Landing Fields

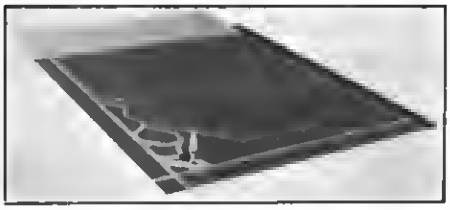
By First Lieut. C. E. Crumrine—Army Air Service

An Airway is an organized chain of airways landing fields that are known terminals, sub-stations, intermediate stops, and emergency landing fields. It serves as a highway for airplane travel.

Airplanes are an essential factor in speeding up business—the business of commerce and war. Once planes are off, they will travel a given distance in one-half the time required by the fastest trains. Getting the plane underway is one of our greatest problems—so much time is lost in housing, repairing, and fueling the plane, and in obtaining the exact weather reports, that sometimes very little time is gained by air travel.

The United States Army Air Service has undertaken the task of organizing an airway which will cure these evils.

If the reader is in any doubt as to the necessity of organized airplanes, let him make two long trips by air. First over an unorganized route, such as we have on a direct line from Dayton, Ohio, to Charleston, S. C., a distance of 550 miles. The start is made—after flying 200 miles, his gasoline runs low—he must look around for an available landing space and pass through the uncertainty of finding one at all. Finally an open lot is sighted, and with great relief a landing is made. The plane is rolling to a stop, when one wheel drops into an unseen hole. A sharp turn results and a tire blows out. No shops handy—a long trip to town—repairs slow and tedious. Then comes the fueling—gas and oil of an uncertain grade must be transported to the field. The day is now nearly spent, so the plane is left in the open exposed to the weather, and the tired traveler lays over for another day. The next day, the same process is repeated and at the end of a third day he arrives at Charleston, having consumed much time and considerable nervous energy.

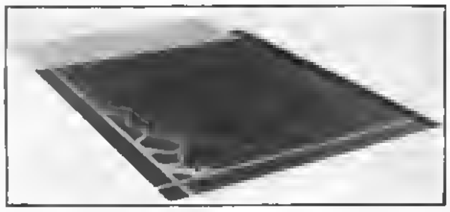


Landing field with beacon tower and border lights added

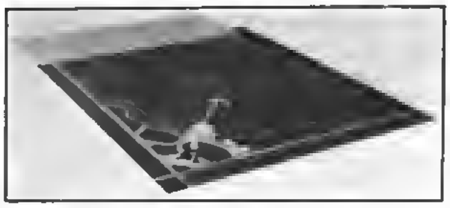
A hangar has been added

Now let us go over the second route—an organized one—New York to Dayton, Ohio, via Washington, D. C., a distance of 620 miles. At 8:00 A. M. we leave Mitchell Field, the Long Island Air Terminal. With a plane well groomed, accurate weather report maps and guide books at hand, the start is made. Every 25 miles a well marked emergency field is sighted. At Pine Valley, N. J., an intermediate stop for ten minutes—then on to Bolling Field, the Washington Air Terminal. Here efficient mechanics inspect and fuel the plane, weather reports are obtained, and in 30 minutes we are under way. Another intermediate stop at Cumberland. Plane is again refuelled at Moundsville, W. Va., (sub-station). Off in 20 minutes. Next landing Columbus—intermediate stop—and at 4:00 P. M. we glide into McCook Field, Dayton Air Terminal. Total elapsed time 8 hours: the best train from New York to Dayton requires 17 hours.

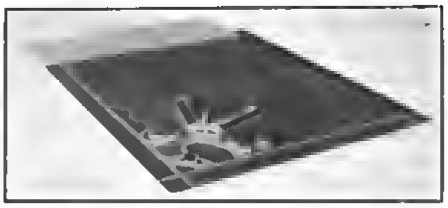
Because of the time and money involved the Air Service is adopting the Thies progressive landing field program. The attached photographs serve to illustrate this program, which will be given its first trial at Columbus, Ohio.



Landing field with gasoline and oil station



A shop has been added



The completed station including shops, garage, and club-house

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(*Concluded from page* 168)

tions must accept the best verdicts of the day, work out their decisions as carefully but as rapidly as possible, and shape their programs accordingly.

Aircraft as a comparatively new element in national councils is subject to considerable polemic discussion; some experts ranging themselves bitterly against it and others equally enthusiastic for it. However, all policy must in the long run accurately reflect the great body of public opinion. Aviation activities all over the world are undeniably popular and seem to denote that public opinion is squarely behind the whole policy. This is particularly true with reference to civil aviation developments.

As the public begins to realize more that in any future conflict, aviation must be depended upon to defend the civilian populations in their homes as well as help fight an enemy on their borders or abroad; a sound and definite aviation policy will be adopted. Such a policy, well formulated, will everywhere command and receive the support of intelligent public opinion and will in time become an integral part of the national consciousness.

(*Concluded from page* 176)

Mixture is provided by a Zenith carburetor, drawing hot air from the exhaust pipe.

This engine is a really sound practical job, which will stand up to any amount of hard wear, and will give continued satisfaction.

A small production batch of these engines is now being put through the shops, and those interested in this type of engine should send further enquiries to the Bristol Aeroplane Company, Ltd., Filton, Bristol, England.

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Reed One-Piece Solid Metal Semi-Flexible Propeller

A semi-flexible, solid, thin one-piece metal propeller, of about the same weight as a wooden propeller, which can be twisted to varying pitches and twisted back again, permitting combinations of 2-bladed propellers to make fours at will, turning at the velocity of sound, may cause many changes in design and new records for speed and weight carrying. General reduction in propeller diameters may result. Suitable for the everymon low-powered low-priced airplane. New propeller will be geared up instead of down. It may lower the power plants of seaplanes and boats and raise pontoons or land gear.

THE highly interesting new propeller of Dr. S. Albert Reed, of New York, is to be marketed by the Curtiss Company. After eighteen months of experience since first flight tests, a number of his novel propellers are in flight service on engines varying from 90 h. p. to 200 h. p. and forgings are now available for 400 h. p. Liberties. The Navy has ordered six 200 h. p. Hispano propellers, five have gone to McCook Field for various tests and preliminary tests have been made abroad by the French and British air services. Three of the Dayton propellers are for high speed planes, and one of the propellers is expected to fly with a tip speed of 1100 ft. per sec., a record. Tests thus far made prove, Dr. Reed claims, that his novel screws are the most efficient in service today, giving a material gain in flying speed for any stated power over any other propellers now known.

Air Reactions to Objects Moving at Rates Above the Velocity of Sound With Application to the Air Propeller

By S. Albert Reed, Ph. D.

IN the course of experiments conducted during the year 1916 regarding acoustic pitch of high frequency, it was found necessary to use an apparatus with arms radiating from a hub and rotating at a very high rate of speed. In an effort to reduce air resistance it was discovered that the arms could be made quite thin and sharp at the edges and still have sufficient strength to withstand centrifugal force.

It was further observed that, through centrifugal force, the arms possessed sufficient rigidity to resist stresses which existed tangential to the circles described by the tips of the blades.

This, naturally, led to the consideration whether a twist (warping) or inclination (pitch) of the arm-blade from the radial plane could be maintained, the arms then acting as blades of a propeller. It developed that with the proper shape and proportion a twist or warp could be maintained with reasonable constancy making it evident that I had, perhaps, discovered an elementary air screw or propeller adapted to very high speeds.

Investigations pertaining to the usual type of propeller disclosed that up speeds seldom exceed 90 feet per second and that the only recorded attempts to explore the higher speeds appeared in a paper issued by the British Advisory Committee for Aeronautics, March, 1919. At this time a tip speed of 1180 ft. per second was reached with a two-blade 9-foot propeller, the observations revealing that, "as the tip speed approached the velocity of sound the usual air flow breaks down entirely, the slipstream rapidly diminishes and ultimately disappears; the air apparently being sucked in on both sides of the disc and exhausted at or close behind the periphery when the velocity of sound is reached."

There has been a tradition general among aeronautical engineers that a critical point exists for tip speeds at or near the velocity of sound, indicating a physical limit in the use of propellers at higher tip speeds; the idea being that something would occur analogous to what is known in marine propellers as "cavitation." Being unable to find a verification of this tradition or a record of experiments along this line, other than the British paper quoted, it appeared that this field had been practically unexplored.

With the new type of blade, described in this paper, it is evident that other and more extensive experiments are possible and that the validity of the existing belief can be tested. It also appeared, in reference to the air resistance of projectiles, that there was supposed to exist a critical point in the plotted curve of speed and resistance at velocities between 1100 and 1200 feet per second. *In the examination of the physics pertaining to both propellers and projectiles moving at or above 1100 feet per second, the conclusion was reached by me that there is no reason for the existence of such a critical point and that, if it had been noted by observers it was not inherent in the phenomena revealed, but rather due to a particular shape or proportion of the projectile and that, with properly proportioned sections, it would not exist.

Berthol. "Guns and Gunnery."

.*Experiments were then begun with thin flat blades of aluminum constructed with sharp edges and set at various angles of twist or pitch up to 45 degrees, and with tip speeds from 700 to 1550 ft./sec.

Series 1. This series was tested in the author's laboratory with a 10 h. p. electric motor at 1150 r. p. m. geared to propeller shaft in ratio of 12.25 to 1, producing a shaft speed of 14,088 r. p. m. or 235 r. p. s. Aluminum propellers of two blades measuring two feet from tip to tip were used, with provision for measuring speed, thrust and torque.

Series 2. This series was made

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Fig. 1—Reed dinalumin propeller D-4 mounted on Curtiss JN with 0x5 engine

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and tested under the author's directions by the engineers of the Curtiss Aeroplane and Motor Corp., at their factory in Garden City, L. I., N. Y. A 100 h. p. aircraft engine at 1500 r. p. m., capable of running at 1800 r. p. m. was used. The gear ratio was 4 to 1, producing a propeller speed of 100 r. p. s. Aluminum propellers measuring 4 feet from tip to tip of blade were used, propellers having 2, 4 and 6 blades of various shapes and proportions, all blades being so thin as to make them devoid of sufficient structural or inherent rigidity to withstand more than a fraction of the stresses of operation, relying mainly upon the virtual or kinetic rigidity due to centrifugal force.

Series 3. Propellers installed on standard well-known types of airplanes and subjected to rigid tests under actual flight conditions.

Discussions

From the well-known formula for centrifugal force it is easily ascertained that, with a velocity of 1500 ft./sec., the radial tension at the tips, in this case, is increased about 32,000 times, i. e., one ounce at the tip produces a radial tension of one ton. With a deflecting force on the whole blade of not over 100 lbs., parallel to the shaft, there would be but a slight flexure, thereby permitting the use of thin blades with sharp edges and a minimum contour, without the danger of rupture. Furthermore, as a matter of convenience and simplicity in manufacturing for testing purposes the boss very plainly can be made quite unlike the helical shape of the regulation propeller as will be seen further on.

Numerous mechanical devices were designed to meet the rather unusual requirements of enormous rotational speed, high power and the necessity of obtaining accurate measurements of thrust and torque.

* * *

The shaft was equipped with a flange which operated against ball bearings, the latter running in a concave receptacle attached to a hinged lever. The free end of this lever was connected to a spring scale, providing a means by which the thrust was measured.

* * *

In order to ascertain the torque stresses in the countershafts intervening between the engine and propeller, measurements were made by the use of an extended arm in accordance with the principle of the well-known transmission dynamometer. The torque of the frame or box, carrying those countershafts, had a certain fixed ratio to the h. p. being transmitted, making it possible to get a very accurate reading.

* * *

In Series 1 experiments were made with 22 and 17-inch propellers given in Fig. 3, the 17-inch being simply a 22-inch propeller with the blades cut off 2.5 inches.

* * *

It is quite apparent from the results obtained in the experiments above and with a two-blade, 4-foot propeller of Series 2, that the ratio of thrust to tip speed undergoes an appreciable variation when exceeding the velocity of sound or even to an excess of 50 per cent in velocity, and that the physics in the problem reveals nothing that would deter the operation of propellers at tip speeds far greater than those heretofore considered possible. The failure of the British experiment, previously referred to, was due, no doubt, to the air turbulence and other disturbing factors resulting from the use of blades not adapted to high speeds.

* * *

From the results in a series of experiments in the region of velocities from 700 to 1400 ft. p. s. with the 22 and 17-inch propellers at 0° pitch, it will be noted that there appears to be no critical point or sudden turn in the plotted curve at or near the velocity of sound.

As to the rate of rotation to velocity, the frequency of the air impulses from one blade of a 2-bladed propeller at 100 r. p. s. is about equal to that of the 3rd F, reaching the middle octaves of a piano. The tone emitted by the 2 and 4-foot propellers when absorbing 100 h. p. is clear, sharply definite as to pitch, and of great intensity, being audible for several miles. The tone is very similar to that of a powerful steam siren and has none of the confused and distressing violence claimed in the British experiment.

The standard 2-blade propeller, of the usual character, when mounted on an aircraft engine with the customary speed of 1500 r. p. m., gives rise to air impulses reaching the ear at about 40 per second, no greater than the lowest base note of a piano and is, therefore, generally not clearly perceptible, as a definite musical tone, mainly because of its depth of pitch. It is also of the same frequency as that of the tone of an 8-cylinder exhaust, but the latter, being more powerful, remains the predominating sound.

Very high speed propellers have an unusual note of great penetration, quite distinct from the roar of the exhaust. Important usage had been made of this tone in experiments, by which it was possible to determine speed and a verification of tachometer readings.

The success of these experiments is due largely to the efficiency with which the profiles were designed in order to get stability of pitch, stabili-

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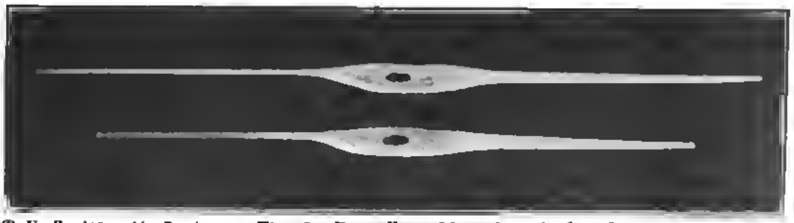
Fig. 2—Reed propeller D-6 mounted on a Curtiss Oriole



© U. S. Army Air Service Fig. 3—Propellers 22 and 17 inches long

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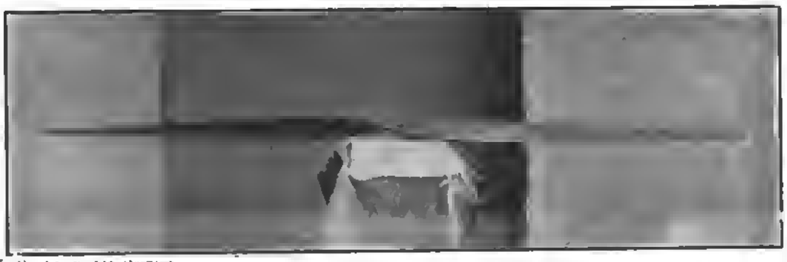


© U. S. Army Air Service
Fig. 4—Reed 8'7" propeller 5/8" thick at hub section; 1/8" at top section; made of a single piece of sheet metal 5/8" thick

ty against fluttering and also against segmental vibration under the action of enormous centrifugal force.

In these designs the resultant of axial, radial, tangential and torsional stresses on the blade at full speed gave a close uniformity of load distribution, the blades, therefore, not vibrating either as a whole or segmentally. If such vibrations do occur, due to an improper form, the thrust diminishes perceptibly, as seems to have been the case in the British experiments, the absorption of power may increase rapidly and become excessive while the sound emitted may be of a most disagreeable character.

With the proper form the thrust and torque progress steadily and in a constant ratio, and the sound emitted is a clear, definite, simple note, the pitch being easily determined by comparison with a suitable tuning instrument.

In order to ascertain the performance of a propeller in actual flight, and owing to the diameter of the propeller making it too large for the wind tunnel, the Curtiss company anchored an airplane immediately in front of the propeller erected for test. The airplane propeller was driven by its own engine and delivered a slip stream parallel to the slip stream of the propeller under test—the wind being controlled to some extent by screens—at an average velocity of 41.9 m. p. h. as indicated by a Pitot tube. The results obtained from this method, although reasonably substantial, are not considered as having the accuracy of those of wind tunnel tests.

* * *

Referring to Series 3, the practical test, nine different propellers were made and used on airplanes in flight; one, the D-4 on a Curtiss JN. OX5 75 h. p. engine, Fig. 4; another, first on a Curtiss standard K6 150 h. p. engine, and afterward on a Curtiss Oriole, 160 h. p. engine, Fig. 2; two others on Curtiss Orioles, and one on an Air Mail 400 Liberty engine. In the first four cases my propeller proved the more efficient when compared with a wood propeller, while with the Liberty engine the pitch being purposely too low for full speed, the flight was made with engine throttled, the propeller turning at about 1900.

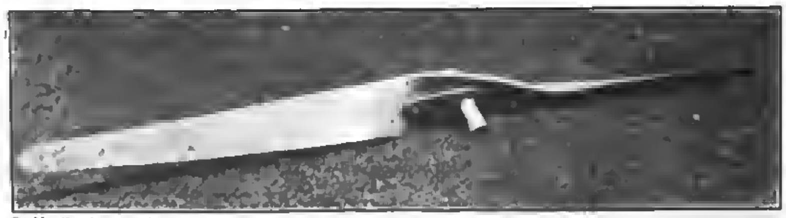
The D-1 and D-2 were tested statically at McCook Field and proved a success. D-1 had been flown several times on a 160 h. p. engine and also endured a 30-hour test successfully. The D-6 was flown a number of times, twice with a passenger, attaining an air speed of between 106 to 108 m. p. h., the usual wood propeller accomplishing a speed of 96 m. p. h. It was again flown on an Oriole, in a race during the Spring meet at the Curtiss Field and won easily against several competitors. It was then given to Amundsen for an Oriole taken on the Arctic expedition. Another propeller, D-8 was tested to destruction at McCook Field in order to determine the maximum blade width in the tip region which a blade of certain root thickness can sustain without oscillation of pitch, or fluttering under the stresses for which the propeller is designed. Tests were also made with a 50 per cent additional overload as required in Government tests. The speed was increased until the pitch broke down, causing violent fluttering which eventually resulted in fracture. With the data thus obtained the maximum power absorption can be determined and when the propeller, so designed, is subjected to test and found to maintain its pitch steadily, it can be relied upon as proof against fracture in service.

The D-26 propeller, 7-foot 9-inches in diameter, with a 9-foot 6-inch pitch, designed for the Curtiss Army racer for the Pulitzer trophy, was tested statically at McCook Field in October, 1922, to over 2300 r. p. m., absorbing 639 h. p. without flutter and without deformation.

In the proportioning of stresses exerted on the blades, in order to maintain the required pitch, there are involved calculations and formulae which differ in some degree from those used for wood propellers, necessitating a departure from established precedents. There is no doubt, however, but that propellers of this type can be adapted for use up to the highest powers and speeds; in fact, at the present time, they are probably superior in efficiency to any other. Being made of solid duraluminum, or an alloy with similar physical properties, and in a single piece, they have no hollow space, weldings or rivets. The weight is almost the same as that of a wood propeller of the same area; and while the advantages of metal over wood are generally accepted, its superior aerodynamic properties are still the prominent and essential factor. This latter feature is due to the thinness of the blades, the use of which without deformation under conditions of service, has been made possible in the Reed propeller.

This propeller may be classed as semi-flexible. It is made of rolled sheet metal 5/8" to 1" thick, annealed, and cut to the desired shape. The tapering in thickness is begun a short distance from the hub center and is continued straight to the tips, at which point the thickness is from 1/10" to 3/16". The back surface of the tapered position is cambered, producing an approved airfoil section, at least, from the 30" station out, with lower surface flat and upper surface cambered. The blades are twisted to the proper pitch and heat treated, after which they are drilled to admit the propeller shaft and then mounted, either on one of the regular wood propeller steel hubs by means of a filler block, or on a specially shaped steel hub, as shown in Figs. 4 and 5. The propeller is then rigid at the center and progressively flexible toward the tips.

In order to further present the theory of this propeller, attention may



© U. S. Army Air Service
Fig. 5—Reed propeller with hoisted flange hub

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be given to Fig. 6, in which the approximate profiles of a typical wood propeller and that of the Reed propeller at the same radii are given, the peripheral speeds in ft./sec. for an 1800 r. p. m. being:

Radii:	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"
F. P. S.	94.2	188.4	282.6	376.8	471	565.2	659.4	753.6	847.8	942

The performance of airfoils is generally assumed to agree with the results obtained in wind tunnel experiments which have been made up to 250 ft. p. s. only, with interpolations for greater speeds up to 900 ft. p. s., the latter being accepted without question, although based upon assumption. In considering speeds which approach the velocity of sound there is reason, however, for not relying upon interpolation, the indication from results for speeds approaching 1100 ft. p. s. being that there is no longer only the increase in pressure on the rear surface and a diminution on the front surface, both contributing to a useful thrust, but also a pressure wave which accumulates around and on both sides of the leading edge and a similar rarefaction wave at the trailing edge.

These pressure waves spread forwardly as well as aft in relation to the course of the airplane, and, therefore, not contributing to thrust, absorb and waste power. As affecting the velocity of bullets, Professor Boys' photographs of bullets in flight, made first in 1893 and described in "Nature", March, 1893, and also in Smithsonian Institution reports of 1893 (similar photographs are now being made by Major Wheelock at the Frankford Arsenal) throw much light on this subject, demonstrating that slowly-moving bullets, having a speed of not over 800 ft. p. s., may have quite a blunt nose without creating a compression wave; but as the velocity approaches and exceeds 1100. ft. p. s., the compression waves become the chief consideration, and are reduced only by the use of a sharp nose, or a small angle, and a cut-away tail. In the Reed propeller the blade sections up to approximately 36" from the hub center, travelling at about 600 ft. p. s., could, therefore, have reasonably thick sections with blunt edges, but beyond this station the thinness of profile and sharpness of edges becomes a very material factor; and in the eight or ten inches of the tip, a portion which contributes largely to thrust, it is a matter of serious importance whether or not the leading edge is blunt or sharp, and with a low angle of edge.

Another advantage, by no means negligible, is afforded in the Reed propeller, in the thrust created by the profiles toward the root of the blades. Although comparatively small, this portion contributes to thrust and also produces a cooling *blast of air against the nose of the fuselage, which is very serviceable when a radiator is used at that point. The profiles in this portion of a wood propeller, as shown in Fig. 6, are thick, and poorly-shaped serving more in the capacity of strength, and do not create enough thrust to even carry their own weight. It may, therefore, be theoretically concluded that the higher efficiency of my propeller is due somewhat to the structure at this point, the determinations, based on experiments, indicating that the net average advantage gained is at least 6 per cent. Considering radial tension as existing specifically in the Reed propellers on account of centrifugal force; calculations reveal that under a speed of 2000 r. p. m. the tension does not exceed 8000 lbs. per square inch of section, and moreover, under 3000 r. p. m. the tension does not exceed 60 per cent of the breaking strain claimed for the material. In the matter of pitch constancy when properly proportioned the propeller will maintain its pitch under a power absorption of 50 per cent in excess of that for which it is designed. Other features of value, not contained in the usual wood propeller, will be readily appreciated, i. e., the pitch is adjustable, and on account of the ductility of the material, the blades can be twisted back and forth a number of times without injury to the material until the desired pitch is obtained. Furthermore, in the case of accidents, causing a moderate deformation, it is possible that the original shape may be completely restored. Still another feature, made possible by the thinness and flatness of the blades at the root, is that by crossing two-bladed propellers, a four or six-bladed propeller is easily provided, or, if preferred, two or more can be mounted in tandem.

* * *

*Readers will recall C. M. Olmsted's propellers designed to salvage thrust at the root.—Ed.

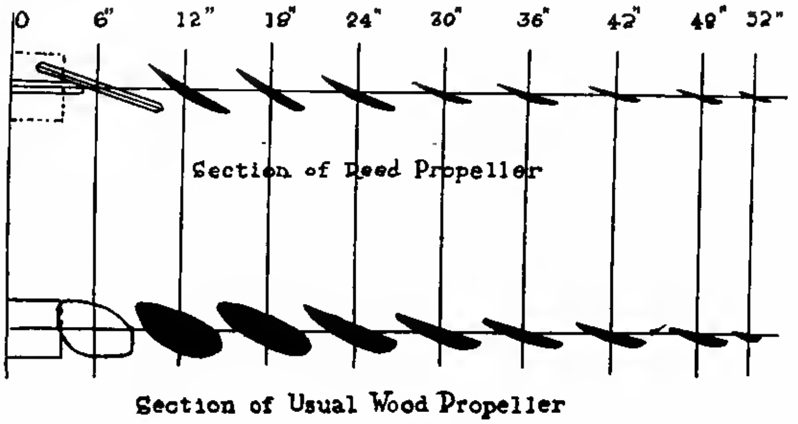

Fig. 6

(*Concluded from page* 180)
program of Standardization in discussing it and adopting it. As long as nobody takes the initiative in originating a movement on Standardization of parts entering in the design of aircraft and aero engines, commercial aircraft cannot be designed, built and repaired at such prices that will make possible the operation of aerial lines on a business basis.

Of course it is not required that the National Aeronautic Association of the U. S. A. should issue Standards. This is not one of the functions of the Association, at least for the time being. But it is very much one of the functions of the Association to act as the connecting link between the many (and sometimes conflicting) interests that will have to be harmonized in order to "Make America first in the Air", which is the proud motto adopted by the Association. To sponsor and to promote the adoption of Standardization, to make a study of the kind of legislation that must be submitted to Congress for approval, and to take an active interest in bringing about the adoption by the Government of a policy of centralization of necessary government services and decentralization of other government services that can be absorbed by the Aeronautical industry, seems to be a good beginning of the many useful initiatives that everybody confidently expects from the National Aeronautic Association of the U. S. A.

An Open Letter to the Members of the Sixty-eighth Congress

Outlining the Duty of Every Congressman Who desires to Have the United States Retain its Proper Place in the World of Aeronautics

By Douglas Wardrop

Gentlemen:

In the life of a nation, as in the life of a man, a moment comes when a certain situation arising from a number of accumulated causes must be faced and an issue must be found.

The moment has come when we must face the critical situation of aeronautics in this country, investigate the causes which have made possible prevailing conditions and put life, order and efficiency in one of the most important branches of our industry, our commerce, and our National Defense.

We have the greatest confidence in the wisdom and in the patriotism of the Sixty-eighth Congress; we have the most implicit faith in the future of aeronautics and therefore we do not hesitate to undertake the unpleasant task of bringing to the attention of all of you, gentlemen, a few cold facts and comments on the present aeronautical situation in the United States which demands action from you for the good will of the nation.

We fully realize that some truths and comments that we will have to bring to your attention in the course of our campaign will strike a very unpleasant note in some aeronautical quarters but we believe that the function of honest journalism is to speak the truth and this is what we propose to do to the best of our ability.

Gentlemen, the truth of the matter is this:

1st: We need federal laws and regulations in aeronautics equally protecting the interest of capital invested in aeronautics, the interests of the public that will have to use aircraft, and the interest of the Government that *must* depend on aeronautics in every national emergency that may arise in the future.

2nd: We must eliminate a good many government services which are doing a kind of work that must and can be taken care of by the aeronautical industry, and are duplicating in two or three departments and committees the same work.

3rd: We must have a reorganization of all aeronautical services affecting the National Defense, leading to the recognition of the fact that aeronautics is not a side issue with either the Navy or the War Departments but is a very vital matter for the future of this Nation of ours and is important enough to demand the creation of an Independent Air Service amalgamating the needs of both the Army and the Navy in so far as aeronautics is concerned and furthermore, amalgamating the interests of the aeronautical industry and the interests of the government at the same time.

4th: We must develop our aeronautical industry, which is in such a shape that if we continue our present aeronautical policies, will be dead in a very short time.

Gentlemen, if we had to-day 10,000 military and naval aircraft supplied by a poorly organized and anemic aircraft manufacturing industry and no pilots to man them we would be in a deep hole if a war should break out to-morrow, while instead, if we had only 500 or less military and naval aircraft and thousands of commercial aircraft manned by civilian pilots and built by a prosperous aircraft manufacturing industry well organized and on a production basis, we would have the pilots and the fighting machines when needed and such as are needed, when the time comes.

5th: In spite of the many world records that we won last year, in spite of the sensational cross country and trans-continental flights that have been made by our gallant Military and Naval pilots, in spite of the fine performance of our air mail service (operated by old worn out types of aircraft) do you know, gentlemen, that we have not a completely dependable power plant for aircraft and commercial aircraft that would be considered as a good risk by any insurance company and would pay dividends to an aerial operating company? Do you know that in spite of the hundreds of millions of dollars that we have spent for military and naval aircraft in the last few years we have failed to offer a competitive prize to the aircraft manufacturing industry for developing a safe type of commercial aircraft, a dependable power plant and a few navigating instruments that are sorely needed before we can honestly demand the public at large to trust their lives and their money in aeronautics?

Gentlemen, the main present day problem in aeronautics is to create a huge military and naval aeronautical organization.

No money should be spared by the Government for creating the conditions whereby our aeronautical industry can grow and aerial operating companies can be organized in this country on a business basis and not as so many liabilities, as is the case in Europe.

In order to do this the first and the most important step to take is to adopt such laws and regulations as are needed, with as little of governmental control on individual business initiative and a generous inducement to capital to find a profitable field of investment in aeronautics as it is possible and expedient to do.

Next step must be to put commercial aeronautics under the control of the Department of Commerce (and not under the control of the Army and the Navy) and to put both the Military and the Naval Air Services under the control of a single department of National Defense amalgamating the needs of both departments and closely cooperating with the aeronautical industry through the Department of Commerce.

Third—Let us spend all the money that is needed for encouraging the development of good standard types of commercial aircraft right in the shops of aircraft manufacturers and not in government plants. Let us spend all the money that is required for scientific research work leading to the creation of safe, cheap and efficient aircraft and let us build them, hundreds, thousands of them, with government money if necessary, for every army racer or bombing machine that we *must* build, and let us use them for carrying the mail all over the country, even if it costs twice as much as it costs now to carry the mail by rail; let us use them for fire patrols and for patrolling our sea coast. Let us use them for every possible service which is now operated

(Concluded on page 200)

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AERIAL AGE

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A NEW pursuit plane was tested last month by the Curtiss Company. It is an all metal biplane, duraluminum construction, except for the wings, which are laminated wood and it is the latest type of aircraft designed by the Curtiss Company.

We are glad to see this latest attempt made by an American firm to tackle metallic construction of aircraft which, for some mysterious reason, has been largely so far the specialty of German aircraft manufacturers.

We sincerely hope that every encouragement will be given by the government to the development of metallic construction in this country.

We do not see anything very mysterious about foreign metallic construction that we could not improve upon if the proper amount of money was spent for tools, jigs and fixtures that are 90% of the secret of a good job of this kind.

Of course it would be poor business judgment on the part of any manufacturer to lay in a costly equipment of special tools needed and gamble on the chance of getting an order from the government that would make it worth while investing in the business the money required for producing a good job.

Would it not be a good plan to provide funds for building twenty metallic aircraft frankly designed for commercial purposes and use them in connection with the U. S. Air Mail Service giving the job to the aircraft manufacturers that will submit the best design of a commercial metallic aircraft at a fair price?

If we never make experiment on a sufficiently large scale of metallic construction we will never know if aerial operating companies of to-morrow will have to adopt metallic aircraft or else will have to stick to wood construction.

THE combined experience of the Air Service of the United States and the Allies during the war goes to show that twenty-five years is about the upper limit of age for fliers, although in a number of instances much older men have done excellent service.

The registration in the first draft showed that there were ten and a half million men in the United States in 1917 between the ages of twenty-one and thirty-one, or roughly, one million for each year of age, which would mean four million between the ages of twenty-one and twenty-five.

The same war experience has developed the fact that roughly only one out of every one hundred young men possesses sufficient mental development and satisfactory physique to stand the strain of flying.

The American Society of Mechanical Engineers bases on this ratio its estimate of the apparent maximum number of young men available for service as pilots of commercial passenger-carrying machines which does not exceed 40,000 and assuming that, at best, not more than one-half of the men available for this service would actually go into it, concludes that we can count on about 20,000 pilots only. Taking 20,000 as a fair estimate of the number of pilots on which we can count, and figuring on having 90% of them always on the job and flying all of them four hours per day we can only have 3,000 airplanes in the air at any time of the day and night.

This number is ridiculously low when compared to the number of men and women who are driving an automobile to-day and the number of automobiles which are rolling on the roads of the United States at any time of the day and night. This number, however, cannot be raised unless we design and build aircraft in which the human equation, represented by the pilot, is not such an important factor as is the case to-day.

This goes to show once more that the main problems of aeronautics to-day are technical problems which must be solved by scientists, engineers and manufacturers and that no money should be spared for making possible the solution of these problems right in the field where they belong, which is *the aircraft manufacturing industry.*

THE horrors of air raids in the future are suggested by a recent article in the "Daily Mail" by an armament expert, recently on the Allied Commission in Germany. He says that in the course of his duties in Germany he examined "two instruments" for dealing destruction and death more terrible a thousand times than the most vivid imagination of fiction.

The first discovery was an incendiary bomb weighing less than one pound which forms on exploding an "incandescent mass of white-hot metal that would melt its way through armor plating. A thousand of these bombs could be carried by one airplane.

The second discovery was a "little glass globe containing a dark brown liquid." When the glass is broken, thousands of cubic feet of poison gas is generated. One raid with airplanes using such bombs would paralyze the very heart of the United States and bring horrible death to most of the inhabitants of New York. These are facts and not pipe dreams. However, what are we doing in order to protect ourselves and other nations from the horrors of an aerial war?

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THE Aicrraft carrier tonnage allowed by the Washington treaty for the reduction of Naval Armaments has alloted both to the United States and to Great Britain 135,000 tons.

At present Great Britain has 62,500 tons of aircraft carriers of first line and 25,900 tons of the second line. We have no aircraft carrier of first line and only 12,700 tons of aircraft carriers of second line.

These eloquent figures should provide food for thought to our legislators. It is quite true that if we have a well organized aircraft manufacturing industry we do not need to maintain a large military and naval air force in time of peace. But if it is true that aircraft manufacturers can turn out hundreds or even thousands of aircraft per day in time of war, the same is not true of ship builders in so far as aircraft carriers are concerned. We cannot build overnight 109,000 tons of aircraft carriers that are needed by the Navy and it is not easy for us to see eye to eye with those who are aiming at disarmament and are neglecting the admonition of "Safety First".

THE chauffuer of an automobile who, due to carelessness on his part, causes injury to a passenger driven by him, is subject according to law to prosecution for manslaughter. Why should not the same legislation apply to careless pilots (both military and civilians) who succeed in saving their lives in an accident after destroying valuable property and endangering the lives of passengers?

We think that a good example of this nature would act more efficiently in developing a better judgment in some pilots than the continuous appeals that we are making to their sense of responsibility to themselves and to others.

Commercial flying must be used by conservative people who have too much respect for their own lives and the lives of others to be subject to the lack of judgment of some pilots that has already cost a good many lives which could have been lived for a hetter purpose.

Wright Patent Expiration and the Manufacturers Association

IN THE March number of AERIAL AGE it was recalled that the Wright patent, around which such a long legal battle was fought, was about to expire.

Lest the article be taken to mean that there are no other patents to be considered, it may be well to add to the previous statement, though one could scarcely interpret the article as referring to any but the one Wright patent of fame.

Some two hundred other patents are as a matter of fact, concerned in the cross-licensing system of the Manufacturers Aircraft Association. One of the considerations of the $200 royalty on each machine manufactured by members, paid in to the association, is the use by members of all development patents of members.

The cross-licensing agreement under which the Wright patent was adjudged of value included at the time of its original making, all the other patents then existing held by manufacturers. The Wright-Martin company was to receive royalties on all airplanes produced by the association members up to $2,000,000 on their then existing patents or until the demise of the patent. The company has received about three-quarters of this sum in royalties. A similar arrangement was made with respect to the larger group of Curtiss patents by which the Curtiss company would receive equal amount of money or until the expiration of one of the controlling patents, in 1933.

The Manufacturers Aircraft Association in which this large number of so-called development patents were pooled was organized as a war measure in 1917, and now consists of 16 makers.

The National Advisory Committee annual report for 1917 says:

"In January, 1917, the War and Navy Departments called the attention of the Advisory Board to the prohibitive prices of aircraft charged by the various aircraft manufacturers, attributing these prices to the extra item of royalty added by each firm in anticipation of infringement suits by owners of alleged basic aeronautic patents who were then threatening all other airplane and seaplane manufacturers with such suits, and causing thereby a general demoralization of the entire industry. After numerous meetings with Government officials, owners of patents, and aircraft manufacturers, extending over a period of several months, the committee recommended the organization of an association among aircraft manufacturers for the purpose of cross-licensing aeronautic patents between the members, such association to be known as the Manufacturers Aircraft Association. The committee cooperated also actively in the determination of the general tterms and conditions of this agreement and in securing its adoption by the leading aircraft manufacturers of the country. The purposes in view of the formation of this association and which it is believed have been achieved, are the following:

1. "The prevention of the virtual deadlock with danger of monopoly existing under the patent situation as obtaining previous to its consumation, and the removal of restraint upon the trade operative under the existence of this patent situation;

2. "The settling or avoiding of all litigation,, actual and prospective, under the previously existing patent situation;

3. "The opening of the industry to free competition of all airplane manufacturers and the opening of all patents held by the membership of the association to equal use and on equal terms.

4. "Provision, as set forth in the articles of agreement, whereby a design originating with a given manufacturer may be put into production and used by another manufacturer with all design data, drawings, specifications, etc., on the payment of a small fee, thus facilitating quantity production of an approved design and stimulating the production of new designs or processes;

5. "The development of financial stability and confidence in the airplane industry, thus making possible the financing of the absolutely needed expansion in order to take care of the expected demands:

6. "Reduced cost of aircraft to the Government by reduction of airplane royalties payable under all patents made available under the association to an amount less than one-half the figures previously demanded under a part only of these patents;

7. "Broadly speaking, the encouragement of airplane production to the highest practicable degree and with reference to the demands of the Government under war conditions."

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Howard E. Coffin, Pres. B.H. Mulvihill, V. Pres. B.F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U.S.A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D.C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

FOR THE guidance of all those concerned in the organization of local chapters of the National Aeronautic Association and for the information of the members of the Association and the public at large, the following memorandum of chapters together with definitions, applications for charters and by-laws, are printed by arrangement with this magazine.

Memorandum on Chapters.

(A) The advantages of the Chapter are—

(1) It provides a means of social intercourse between the members, and an opportunity for members to broaden their acquaintanceship and their usefulness to their communities through committee work.

(2) It provides a community with a strong unit of a national body which, by its construction, is able to reach every phase of activity in that community on aeronautic matters.

(3) It provides an agency which, in the future, will be able to handle most of the detail of membership renewals and records.

(4) By the fact that the Chapter is a newly-created organization, which is able to cooperate with every pre-existing organization in the community, all danger of arousing dissension and jealousy on the grounds of favoritism, is done away with. The Chapter can only be organized after the membership of the particular community reaches one hundred. This provides a nucleus which can be greatly expanded once a Chapter is formed.

(5) Through the committees of a Chapter, the Association is able to hold out to prospective members interesting, patriotic, broadening and instructive work.

(6) When a member of the Association has a local Chapter available, the Association is able to keep him interested in the work of aeronautics and the Association; and the possibilities for renewals is greatly increased.

(B) Committees:—

National Headquarters has provided that each Chapter will have the committees listed below, and will issue a pamphlet entitled "Instruction for Forming Chapter Committees", and will also furnish bulletins, letters, and general information from time to time entailing suggestions to Chapter Committees, and requiring reports which will keep the committees active.

These committees are:—

(1) Finance and investment.
(2) Airways and landing fields.
(3) Junior activities and education.
(4) Publicity.
(5) Membership.
(6) Entertainment.
(7) Legislation.

(C) Instructions to Committees:—

The instructions on forming committees and suggestions, bulletins and assistance emanating from National Headquarters will be based on the following for each committee:

(1) Finance and investment:

a. Formation of Committee.

This committee should be comprised of leading bankers and investment brokers.

b. Suggestions.

The committee will pass on all questions of finance affecting the Chapter and its work; should cooperate with the Airways and Landing Fields Committee, by providing plans for the financing of any project sponsored or proposed. It should investigate carefully any aeronautic investment proffered the public in the community; prepare budgets for meets, events or entertainments promoted by the Chapter; arrange for the financing of the Chapter.

c. National Headquarters.

National Headquarters will furnish members with articles, pamphlets, suggestions and data on any phase of finance bearing on aeronautics; will keep the committee informed on aeronautic progress and development from an investment point of view. Confidential reports on all responsible and irresponsible companies will be furnished. Cooperative contact will be established by National Headquarters with bankers' associations, the Aeronautical Chamber of Commerce, and the Investment Committee of the U. S. Chamber of Commerce.

(2) Airways and Landing Fields:

a. Formation of Committee.

This committee should comprise real estate dealers, bankers, contractors, civil, electrical, and mechanical engineers, architects and pilots.

b. Suggestions.

This committee should take steps to obtain a civic landing field. Plans should conform to regulations laid down by the Airways Section, Air Service, U. S. A., and those provided by the Safety Code Committee, Bureau of Standards. Contact should be established with the nearest cities, in order to promote a series of landing fields, which could be utilized as an airway.

c. National Headquarters.

National Headquarters will furnish this committee with War Department documents, maps, copies of proposed Safety Code, and special bulletins. It will establish co-operative contact with organizations working on allied subjects. Price lists of supply houses, estimates and blueprints of equipment, and all other material to be used, will be provided.

(3) Junior Activities and Education:

a. Formation of Committee.

This committee should have as members the president of the School board; members of the leading private institutions; the president and some professors of the local college or university, if any; a few select teachers, and the pastors of those churches most active in child welfare.

b. Suggestions.

This committee should arrange for a course of talks on aeronautics in the different schools; cooperation with the local boy scout masters; prize essays; newspaper essay contests; and carry on any other work which will not only stimulate the interest of the youth in aeronautics, but instil a proper patriotism and appreciation of the importance of preparedness.

c. National Headquarters.

Pamphlets, bulletins, and detailed suggestions will be furnished the committee by National Headquarters. National Headquarters will arrange co-operative affiliations with the boy scouts, educational societies, and Government and State organizations.

(4) Publicity Committee:

a. Formation of Committee.

This committee should have as members the editors of the leading local papers, magazines and journals; local literary celebrities, writers and theater owners.

b. Suggestions.

This committee will arrange for the proper treatment of aeronautics by newspapers; assist Junior Activities and Education Committee in arranging essay contests; obtain items of news value, and cooperate through the committee department of National Headquarters, with the Director of Information.

c. National Headquarters.

National Headquarters will prepare local publicity features for release; information bulletins; pamphlets of instruction and suggestions for this Committee.

(5) Membership:

a. Formation of Committee.

This committee should be comprised of the members of the Chapter who are active in social, civic and society organization work.

b. Suggestions.

This committee should arrange through the Advisory Committee special membership drives to be carried on in all organizations in the community; should work in close harmony with the Junior Activity and Entertainment Committees, and endeavor to keep a large average of memberships coming in. It should see that each representative of any organization serving on the Advisory Committee becomes a member. It should prepare and keep records of prospects, and plans for future campaigns.

c. National Headquarters.

Bulletins and suggestions, as well as active cooperative assistance on the part of paid executives of both National and District Headquarters, will be forthcoming.

(6) Entertainment Committee:

a. Formation of Committee.

This committee should comprise members prominent socially, persons active in theatrical work, fliers, and others prominent in the community.

b. Suggestions.

It will arrange for luncheons, balls, dinners, lectures, meets and other special events, and endeavor to provide social entertainment for the Chapter.

c. National Headquarters.

Speakers, cooperation of the National Contest Committee, bulletins, pamphlets and suggestions, will be furnished by National Headquarters.

(7) Legislation:

a. Formation of Committee.

This committee should comprise the leading lawyers, and those in the forefront of political activity of the State, residing in the particular community.

b. Suggestions.

This committee should keep in touch with all Federal legislation and all legal phases of aeronautics.

c. National Headquarters.

Information bulletins and pamphlets, and other suggestions, will be furnished from time to time by National Head-

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quarters.

(D) Advisory Committee:—

Under Article VII, Sections 1 and 2 of the Chapter Constitution and By-Laws, all local organizations may have from one to five representatives to attend all open meetings of the Chapter, and serve with the Board of Directors on an Advisory Committee.

a. Formation of Committee.

This committee should be composed of as many of the five representatives as possible of such organizations as the local Kiwanis Club, Lions Club, Rotary Club, Chamber of Commerce, local Aero Club, Air Board, Merchants' Association, Manufacturers' Association, Board of Trade, Women's organizations, etc.

b. Suggestions.

This committee should devise plans for joint lectures, circularizing the respective membership of each organization for membership in the National Aeronautic Association; promulgation of aeronautic information; obtaining the interest of, and active work for all aeronautic civic development of each organization.

c. National Headquarters.

National Headquarters will furnish pamphlets, suggestions and data to this committee from time to time, as well as lend assistance, such as speakers, organizers, etc.

(E) Women's Advisory Committee:—

When sufficient women become members of the National Aeronautic Association from any Chapter community, they should immediately be formed into a women's Auxiliary Committee.

a. Formation of Committee.

This committee should comprise those women members of the Chapter who are active in social, civic, educational and political work.

b. Suggestions.

This committee should establish active cooperation with all local women's organizations, such as the Red Cross Chapter, League of American Pen Women, Women's Cluhs, Daughters of the Confederacy, Daughters of the American Revolution, League of American Women Voters, etc. The committee should carry on any activity which it deems necessary, not only for the advancement of aeronautics, but to further any civic cause of general benefit to the community.

c. National Headquarters.

National Headquarters will furnish the committee suggestions, contracts, data and information which it is deemed will assist.

ANY ten members of the National Aeronautic Association of U. S. A. residing in the same community may make application for authority to form a Chapter. Upon receipt of such application, approved by the Governors of the District in which the community is situated, the applicant members will be granted a Charter by the National Body authorizing the creation of a Chapter under terms and conditions which will be uniform throughout the nine Districts of the Association: Provided, however, that no application for the Charter of a Chapter will be approved unless at least one hundred members, in good standing, reside in such community.

A Chapter is designed to bring into an organized unit in a community the members of the association in order to promote social intercourse; to concentrate the efforts of the members in the furtherance of Aeronautics in the community; to add strength to the National Body by providing an organized sub-division in each locality, and to carry out such local aeronautic events as are approved and which will have the cooperation of the National Aeronautic Association.

APPLICATION FOR A CHARTER

AUTHORIZING THE FORMATION OF A CHAPTER OF THE

NATIONAL AERONAUTIC ASSOCIATION OF U. S. A.

IN

Whereas we, the undersigned, are members in good standing of the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. residing in........................ And

Whereas the members in good standing of the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. residing in.... ....,total ....; And

Whereas we realize the importance and advantage of forming ourselves into a Chapter in order more effectively to further the work of the Association; And

Whereas we are familiar with the necessity of applicants conforming to the rules and regulations governing the formation of such Chapters; And

Whereas we agree to arrange for the election of the proper officers and committees; And

Whereas we are familiar with, and agree to adopt, the provisions of the Constitution and By-Laws for a Chapter;

Now, therefore, We request a Charter from the NATIONAL AERONAUTIC ASSOCIATION of U. S. A. granting us authority to create a Chapter in the City of ....

State of ....

Approved:

....

Governor.

....

Governor.

Signed

....

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By-Laws

of the ————————————Chapter

National Aeronautic Association of U. S. A.

ARTICLE I

Name

SECTION 1. The name of this Chapter shall be the .... Chapter, National Aeronautic Association of U. S. A.

ARTICLE II

Objects

SECTION 1. The objects of this Chapter are:

(a) To bring into closer relationship all members of the National Aeronautic Association residing in, or near, the City of ....,State of ....

(b) To create an organization in the City of...........,State of.........., which will more effectively carry out the policies of the National Aeronautic Association.

(c) To more effectively stimulate interest in, and disseminate information of, aeronautics in the City of.............., State of..............................

(d) To provide an organization which, because of its greater local strength and its connection with the National Association, will be able to keep the City of..... ...., State of ...., abreast of aeronautic figures.

(e) To create an organization which will lead the City of................... State of ...., in all aeronautic matters.

(f) To provide an organization which is able to analyze and report upon all aeronautic undertakings which may be offered to the citizens of the City of...... ....,State of ....

ARTICLE III

Membership of Chapter

SECTION 1. All members of the National Aeronautic Association of U. S. A. residing in, or registered on the rolls of the National Organization as of, the City of.............., State of.............., are perforce members of this Chapter.

SEC. 2. Any member upon change of residence will be transferred to the roster of the District of his new residence and assigned to the Chapter nearest thereto. upon application of the said member to National Headquarters; provided, however, a Chapter exists within the new state of residence and within one hundred miles of such residence.

SEC. 3. All fees, dues, quotas and allowances as are now provided, or may be provided in the future, in favor of the Chapter from which a member is transferred, shall terminate in respect to said Chapter as of date of said member's transference, and thenceforth shall be granted the Chapter to which such member is assigned: provided, however, that membership fee quotas, once paid a Chapter, will not be transferred to any other Chapter.

ARTICLE IV

Directors, Meetings and Elections

SECTION 1. The Business and Property of this Chapter shall be managed by a Board of Directors, consisting of not less than five nor more than nine members, elected as provided in Article IV, Sec. 2 below. The Directors shall also be responsible to the National Association that the Chapter follow all policies and regulations of the District Headquarters and National Headquarters.

SEC. 2. Those members who sign the roster, attached hereto, and who are in good standing, shall be entitled to vote at all elections and on all matters brought before any meeting of the Chapter.

SEC. 3. A meeting of all the members of the National Aeronautic Association of U. S. A. residing in, or near, the City of ....,State of................, will be called immediately upon receipt of the Charter, such meeting to be held within fifteen days thereafter. At this meeting these Articles are to be adopted, and the Board of Directors and such officers as are provided for in Article V, Sec. 1 below are to be elected.

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SEC. 4. The regular annual meeting of the members of the Chapter shall be called each year within thirty days after the General Convention of the National Association to act upon the policies adopted by said General Convention, and to elect the Directors and Officers of said Chapter for the ensuing year. Other meetings of the Chapter may be called from time to time at the discretion of the Directors.

SEC. 5. A majority of the Directors shall constitute a quorum, and a vote of a majority of a quorum shall determine all matters before any Directors Meeting. The Directors shall meet at least six times a year and special meetings may be called by the President or by any two members of the Board at their discretion.

SEC. 6. Each Chapter shall appoint and send three delegates for the first one hundred of its membership, and one delegate for each additional one hundred membership or fraction thereof, to the District Convention, as provided in the Constitution and By-Laws of the National Association.

ARTICLE V

Officers

SECTION 1. The Officers of this Chapter to be elected by the members of the Chapter shall be a President, a Vice-President, a Secretary, and a Treasurer, who shall, by virtue of election to these offices become members of the Board of Directors. If the growth of the Chapter warrants the appointment of an Executive Secretary to conduct the routine business of the Chapter the Directors may appoint such an officer and delegate to him such powers as the Board sees fit.

President

SEC. 2. The President of the Chapter shall preside at all meetings of the Chapter and of the Board of Directors, shall be ex-officio member of all committees. and shall see that the secretary calls all meetings as herein required or as determined upon by the Directors. He shall see that all reports and records required by the Directors, the District Headquarters and National Headquarters, are kept by the person designated. He shall also see that all of the policies and regulations of the District Headquarters and National Headquarters are complied with.

Vice-President

SEC. 3. The Vice-President shall perform all the duties of the President during his absence.

Secretary

SEC. 4. The Secretary shall keep such records. call such meetings. and make such reports as are herein provided for or as may be required by the Directors, District Headquarters and National Headquarters.

Treasurer

SEC. 5 The Treasurer shall keep such funds and records in such manner as shall be provided by the Directors. provided. however. that the depository shall be named by the Directors and the disbursements from any bank account be by checks signed by the Treasurer and countersigned by one other officer to whom this duty is delegated by the Board of Directors.

ARTICLE VI

Committees

SECTION 7. The Directors must name the following Committees and see that they are supplied with the necessary instructions and bulletins furnished by District or National Headquarters:

(a) Finance and Investment.
(b) Airways and Landing Fields.
(c) Entertainment.
(d) Junior Activities and Education
(e) Legislation.
(f) Publicity.
(g) Membership.

SEC. 2. Such other Committees as are found necessary because of local conditions may be appointed.

ARTICLE VII

SECTION 1. Any distinctly local organization, or local branch of a State or National, Business, Civic, Patriotic, Charity or Social organization may delegate from one to five of its members, in good standing, residing in, or near, the City of ....,State of ...., to attend all open Meetings of the Chapter as representatives of such organization. Nothing in this or the following Section is to be construed to preclude either a Member of the Chapter serving as such Representative or such Representative becoming a Member of the Chapter by joining the National Association.

SEC. 2. An Advisory Committee shall be formed consisting of these Representatives and of the Board of Directors of the Chapter. The purpose of this Committee is to bring about greater harmony, cooperation and effectiveness in the work of the Chapter on all matters pertaining to the general aeronautic welfare of the City of ....,State of..............

ARTICLE VIII

SECTION 1. These Articles may be changed by a majority vote of the members of the Chapter, provided, however, that proposal for such change be first submitted by the Directors to, and consent obtained from, the Governors of the District and the President of the National Association.

GUIDE BOOK OF AIR LINES IN THE UNITED STATES.

In co-operation with the National Aeronautic Association, the United States Touring Information Bureau, for the first time in the history of this country, includes in its directory a map of air lines in the United States, together with the location of more than 3,000 landing fields, improved and unimproved, which stretch from the Canadian border to the Mexican boundary. Together with the map is included a compilation of the various facilities offered at landing fields for the use of itinerant flying. for regular air lines, and for Government use, either for the Air Mail or in connection with the Army and Navy services.

This data was secured in co-operation with the National Aeronautic Association of the United States, in conjunction with the Army Air Service, the Airways Section of that service contributing the records of its well-organized airways section.

The Bureau and the Association realizing that two of the factors which are retarding the development of commercial aviation on a grand scale in this country are the lack of adequate landing fields and the lack of suitable gasoline supply stations, have united in an effort to spread the information regarding the facilities which are available, with the hope that our citizens will respond to the need of establishing more landing fields and gasoline stations which will not only contribute to their own economic advantage, but will fulfill in a large measure the purposes of both the Bureau and the Association.

Aviation, now having become a commonplace activity throughout the country, it was felt that to supplement the touring information service and camp ground directory with information covering the landing fields of the United States and their facilities, together with route maps, would be invaluable to the touring public. Therefore, there has been installed in the office of the United States Touring Information Bureau at Waterloo, Iowa, a service for aviation comparable to that rendered to automobile tourists. This is a unique feature which is not available elsewhere in this or any other country, and the Bureau believes that it is making history in this new departure in its service.

Aviation naturally depends upon the automotive industry for its advancement along technical lines. Therefore, it is closely allied with the automobile industry, the two going forward hand-in-hand in the development of our transportation facilities in connection with the ever increasing demand for speed and promptitude in commercial transactions. In consequence of this allied interest, the U. S. Touring Information Bureau will be from now on, able to furnish to its patrons accurate information regarding landing fields now installed, airways now in operation, and those which will be developed from time to time. Frequent additions to this guide will be most lavish in the direction of completeness, and patrons of the Bureau and members of the Association will have the most up-to-date facilities at their disposal. This guide is furnished free to members of the N. A. A. together with the new Service Bureau Information.

The Headquarters of the National Aeronautic Association are located at Washington, D. C. but it has nine districts with headquarters comparable to the nine Corps Areas of the Army, thus linking into the chain of national defense established by the Government. The districts are divided into numerous chapters throughout the country, thereby comprising one of the most comprehensive and constructive movements ever undertaken in any phase of transportation development.

At the headquarters of the United States Touring Information Bureau, at Waterloo, Iowa, information is on file covering the locations of the District Headquarters and the various chapters of the National Aeronautic Association throughout the United States. Persons desiring information in regard to these matters may write into the Bureau Headquarters and such information will be freely and gladly given.

The members of the N. A. A. are invited the use of this service. It is complete, and of great economic value. Tours will be laid out upon request making use of all available transportation facilities furnished hy the aeronautical industry at the present time, and as such are put into operation and made available.

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THE NEWS of THE MONTH

Wright Aeronautical to Build Planes

The following announcement was made by F. B. Rentschler, president of the Wright Aeronautical Corporation:

"After careful consideration, our company is now providing facilities for carrying on the experimental development of plane types. It is believed that active development of complete units for aircraft will ultimately make for the best product.

"Sometime in March we expect to have ready for occupation a new plant, constructed alongside our present one, which will house our plane activities. This plant will be just as modern in every detail as our present one, and will be sufficient to carry out our present program.

"It is expected that by spring we shall have concluded negotiations for flying facilities at some place adjacent and convenient to Paterson.

"Because of the intense concentration necessary during the war, it seemed advisable for our company to devote its entire activities to the development and manufacture of aeronautical engines. It was, therefore, quite natural that at the end of the war period we should continue to engage principally in the manufacture and development of engines. It is, of course, entirely consistent that the organization bearing the name of Wright should eventually resume the development and manufacture of complete airplanes."

Plan Flying Tournament For Sesqui-Centennial.

Plans for an internation flying tournament to be held by the Aero Club of Pennsylvania during the proposed Sesqui-Centennial exhibition in 1926 were considered at the meeting of the club at the Engineers Club last night. It was also announced that a semi-weekly dispatch edited by the club would be broadcast from one of the local stations within a few days. An illustrated talk was given by W. N. Jennings on aerial photography. President W. Wallace Kellet appointed the following committee on the proposed tournament: Hollinshead N. Taylor, B. C. Dallin, C. T. Leudington and Roy G. Miller.

New Plans of Curtiss Co.

The majority stockholders of the Curtiss Aeroplane and Motor Company, through C. M. Keys, the largest stockholder in the corporation, on March 13 announced that a plan calling for the rorganization of the company's financial structure has been worked out and was being presented to all stockholders for their approval. The plan, according to Mr. Keys, calls for no new financing and results in the decrease of the present outstanding capitalization.

The plan calls for the creation of two new companies out of the present organization, one of which will be a purely manufacturing company. The other will be engaged in liquidating assets. The manufacturing company will probably be known as the Curtiss Aeroplane and Motor Company and the other the Curtiss Assets Company.

The statement issued by Mr. Keys, in part follows:

"The Curtiss Assets Company will buy commercial aeroplanes and motors and spare parts, worth approximately $1,600,000, and also all the American aeroplane patents from which royalties are now received. The Assets Company will issue $2,731,500 certificates of beneficial interest, which will ultimately become the property of the present preferred stockholders. As assets are liquidated, either by sale or receipt of royalties, the funds will be distributed directly to the preferred stockholders. A contract will be made between the two new companies under which the manufacturing company will meet all of the expenses of the Assets Company, just as the present corporation

The Navy-Wright plane, equipped with Wright T-2, 12 cylinder engine. The first complete airplane of the Wright Aeronautical Corporation

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meets all of the expenses at the present time."

Operating Results of Curtiss Co.

The following statement was supplied to the press on February 22 by C. M. Keys, President of the Curtiss Aeroplane and Motor Corporation:

To the Stockholders, Curtiss Aeroplane & Motor Corporation: The operating results of your company for the year 1922, subject to audit by Price, Waterhouse & Co., and therefore, subject to minor change, showed a profit of $16,169.94, compared with the profit of $101,207.17, for 1921.

Orders on the books at the close of the year amounted to $3,752,009.02, as compared with **$1,763,224.55,** in 1921.

The policy of concentrating the efforts of the corporation on engineering, which was inaugurated when the present management took control of the corporation in 1920, culminated during the year in the establishment of a new method of cooling motors and in the winning of the Pulitzer Race, in which Curtiss ships finished first, second, third, and fourth, all four making world's records for a closed course.

This success is directly responsible for the re-entrance of the corporation into motor building on a substantial scale. This, in turn, has resulted in the re-opening of a part of the Buffalo factory so that this unit, instead of being a burden on the company's finances, should be in 1923, the most profitable part of the company's plant.

The policies of the company will remain unchanged throughout 1923. It is necessary to revise the capitalization of the company and a plan to this effect will he submitted to the stockholders shortly for their approval. It may also he necessary, in view of the larger volume of business being transacted, to arrange for the raising of working capital. The possihle need for this is reflected in a decrease of cash on hand at the close of the year from $994,880.52 in 1921, to $174,744.12 in 1922, and an increase of the Government work in production from $122,629.81 in 1921, to $791,978.62 in 1922.

At the Annual Meeting of the Curtiss Aeroplane & Motor Corporation, retiring directors were reelected, and Arthur H. Marks, New York, President of Skinner Organ Co., and former President of Diamond Rubber Co., was elected a director to fill a vacancy.

New Aeromarine Enterprise

A network of aerial commercial transportation routes following the waterways and coast lines of the United States will be put into operation as soon as the personnel and equipment can be developed, Charles F. Redden, President of Aeromarine Airways, Times Building, has announced. In connection with the program of expansion, Mr. Redden said that an Aeromarine Advisory Board, consisting of thirty-five industrial, banking and aeronautical men, had been formed to arouse the country to the necessity of developing support of commercial aircraft.

The Aeromarine plans to inaugurate flying boat service between New York and Miami (daily service beginning next Fall); New York and Chicago via Montreal, Buffalo, Cleveland and Detroit with stops at these cities; Galveston and Tampico, New Orleans and Havana, New York and Newport, R. I.; Los Angeles and Catalina Island and Vancouver, B. C., and Seattle.

The Aeromarine Company, which is said to be the largest operator of flying boats in the world, at present maintains routes from Miami to Nassau and Bimini, and Key West to Havana, in addition to a sightseeing service around Manhattan. Last Summer the company operated a route hetween Cleveland and Detroit and from this city to Atlantic City and Newport.

Among the members of the Aeromarine Advisory Board announced hy Mr. Redden are: Rear Admiral W. F. Fullam, U. S. N.; Colonel Sidney D. Waldon, formerly President of the Detroit Aviation Society and a leader in aeronautical development; Colonel J. G. Vincent, Vice President of the Packard Motor Car Company and designer of the Liberty motor; Colonel H. H. Emmons, President of the Detroit Board of Commerce, Allan Jackson, Fifth Vice President of the Standard Oil Company of Indiana; John D. Larkin Jr., Vice President Larkin Soap Company; R. C. Hyatt, Vice President Union Trust Company, Cleveland; W. E. Scripps, Vice President of The Detroit News; E. C. Romfh, President The First National Bank, Miami; E. G. Sewell, President Miami Chamber of Commerce; Professor Edward P. Warner, Massachusetts Institute of Technology; C. J. Tilden, Chairman, Division of Engineering, Yale University; C. F. Marvin, Chief of Weather Bureau; Gordon Lee, formerly Chief of the Automotive Division, Department of Commerce; Colonel H. W. Alden, Chairman of the board, Timken-Detroit Axle Company, and General Alberto Herrera, Chief of Staff of the Cuban army.

Commenting on the project, Mr. Redden said:

"Believing that aeronautical development has now reached a point where it is entitled to public support on a substantial scale, when conducted under proper auspices, we have asked this committee to cooperate with us in our efforts to put the cause of commercial aviation on a permanent basis. In the course of our operations we have built up a fleet of air cruisers and developed a flying organization which has established a record of performance that has never been equalled heretofore except possibly by the United States Air Mail Service. With more than 1,000,000 passenger miles flown and 20,000 passengers carried, we have demonstrated conclusively that flying is safe, and, further, that, given a safe and efficient flying service, the puhlic will take advantage of this newer and speedier means of transportation.

Some of the planes of the Johnson Airplane Co. at Johnson Field, Dayton, Ohio

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"During the coming twelve months it is our intention to add extensively to the Aeromarine Airways service by opening up new routes and increasing the facilities of present lines, and it is in preparation for this step that we have obtained the co-operation of this committee. Being firm believers in the future of air transportation, as these prominent men are without exception, we are satisfied that their co-operation will be an assurance to the public that this great young industry has now established itself on a sound and permanent basis."

The officers of the Aeromarine Airways, Inc., are: President, Charles F. Redden; Vice President, John W. German; Development Director, H. F. Bruno, and Chairman of the board, Inglis M. Uppercu.

Important Notice to Air Pilots

All airplane, balloon and dirigible pilots, who have secured their Federation Aeronautique Internationale brevets, are requested to send their brevets to the Contest Committee of the National Aeronautic Association of the U. S. A., 26 Jackson Place, Washington, D. C., with a request for yearly aerial license, which is issued without charge. The brevet will be returned, together with the license.

It is necessary for all pilots entering aviation meets or other aerial events to present the annual license in connection with the brevets, which will indicate that they are pilots in good standing, that they are constantly engaged in flying and, therefore, qualified to enter into aeronautic competitions.

The Boston Airport

The new Boston Airport is located on land recently filled by the Commonwealth of Massachusetts between Jeffries Point, in East Boston, and Governors Island. It lies approximately one mile east of the State House dome.

The field for the present will consist of two runways in the form of a T 1,500 feet long. Cross bar of T runs northeast-southwest, base northwest-southeast. The runways are covered with cinders for a width of 100 feet and graded for 50 feet on each side of that. Four hangars are being erected southwest of the runways.

Landings should be made on the runways, as the remainder of the field is impractical for landing at present. The runways can be seen easily, as the cinders contrast sharply with the surrounding light-colored clay.

The field will be ready early in the spring of 1923.

Further information may be obtained from the Boston Chamber of Commerce or from the Air Officer, First Corps Area, Army Base, Boston.

Schneider Cup Race

The Navy Department has informed by cable March 8 that the European speed classic for Jacques Schneider aviation marine trophy will be held off Cowes, Isle of Wight, England, on Sept. 28. The entrants will have a contest for navigability on Sept. 27.

The National Aeronautic Association on behalf of the Bureau of Aeronautics of the Navy has entered three seaplanes in this international competition. It is the first time the United States has entered the contest for the trophy worth 25,000 francs offered by the Aero Club of France. The competition is under the direction of the Federation Aeronautique Internationale, which is represented in America by the National Aeronautic Association, with headquarters at Washington.

Entries have already been made by aero clubs of Great Britain, France and Belgium.

Free Balloon Contest

Commercial organizations and aero clubs of Detroit, Indianapolis, Milwaukee and San Antonio have all filed claims to the free balloon competition scheduled for early June with the contest committee of the National Aeronautic Association. According to B. Russell Shaw, chairman of the committee, there never has been such intense rivalry for this elimination event so early in the year, nor so strong backing by four large cities of their local claims. Milwaukee, where thirteen contenders started in last year's race that was won by Major Oscar Westover of the Army Air Service after a sensational flight, is doing its utmost to cinch this year's event. The aero club of Indianapolis has started an active campaign, and in Detroit and San Antonio enthusiasm is running high

Three mystery entries for the contest are causing balloon sharps to speculate on identity of the probable pilots; two new balloons will be entered by the Aircraft Development Corp. of Detroit, and St. Louis will enter a new pilot.

The preliminary list assures the appearance of Ralph H. Upson, of Detroit, winner of the James Gordon Bennett trophy in 1913; Capt. H. E. Honeywell, of St. Louis, who was second in last year's race and protested the award of the trophy to a Belgian balloon; Capt. G. L. Brumbaugh, of Indianapolis; Major Oscar Westover, U. S. Army Air Service; Lieut. Comdr. J. P. Norfleet, U. S. Navy; Capt. John Barry, of St. Louis, the first man to make a parachute leap from an airplane; Roy Donaldson, of Springfield, Ill., Ward T. Van Orman, of Akron, O., and J. S. McKibben, of St. Louis, all contenders in former races.

There will be a purse of $3,000 for the prize winners, from whom will be selected three contestants and three alternates for entry in the International balloon race for the James Gordon Bennett trophy to be held in Belgium, Sept. 23. The American record for free balloon flight has stood since 1910 when Allan Hawley of New York City covered 1,172 miles. The world's mark, made by Berliner of Germany in 1914 is 1,897 miles.

A Deserved Compliment

Richard R. Blythe, chairman of the Aircraft Executive Association has received the following letter from President Warren G. Harding:

"It is a pleasure to make acknowledgment of the fine contribution which the Aeronautic Executives Assn. has made in behalf of aeronautics in this country. It is, I must confess, a little hard for me to believe that there should still be at this late date occasion for special efforts at arousing and maintaining public interest in this new mode of transportation and of national defense. To me, the suggestion of making a special effort to sustain interest in aeronautics seems a good deal like going back eight or nine decades and defending the introduction of the steam railroad. It seems just as apparent that the navigation of the air is bound to be one of the most important modes of transportation, as it is that the navigation of the iron highways has already become such a facility. Rapid, sure and economical transportation comes very near to being the very corner stone of our modern civilization. Certainly we cannot doubt that the highroads of the air are destined to be among the most used and useful means of transportation. Every contribution to the development of this new art must, therefore, be a contribution to the growth of better civilization."

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$25,000,000 Annually Suggested for Army Aeronautics

In his final report as Assistant Secretary of War, made public March 12, J. Mayhew Wainwright, who resigned on account of his election to Congress, advocated the adoption of a program calling for an annual expenditure of $15,000,000 in the next five years for the development and expansion of the Army Air Service, besides $10,000,000 annually for operating the service. Industrial mobilization in time of war was also dwelt upon by Mr. Wainwright, who said that the plans of the War Department in that respect were far advanced. "Our most notable deficiency at the present time," Mr. Wainwright said, "is in the matter of aircraft. The situation in the Army Air Service is most critical. Up to the present time this service has been using very largely equipment produced during the war. This supply is practically exhausted. What there is left of it is disappearing rapidly, due to deterioration and to the inevitable losses while in actual use.

"The amounts appropriated for the purchase of new air craft are insufficient to provide what is necessary even for the normal peace time equipment of the present small air service organizations.

"The aeronautical industry in the United States, built up to large proportions during the war, is now practically facing extinction. Until commercial aerial transportation becomes a fact the only demand for such equipment originates with the military branches of the Government. Unless the Government places with aircraft manufacturers sufficient orders to enable them to continue in operation the industry as such will disappear.

"The Army Air Service is faced with this condition of affairs: Its wartime manufactured equipment has heen practically used up. The amounts of money appropriated for the purchase of new aircraft are so small that within two years it will have on hand less than one-half the number of aircraft necessary for normal peace time work.

"There will be no aircraft to equip and expand the air service in time of emergency, no reserve on hand, and it will be impossible in less than a year to expand the remnant of the aircraft industry which may be left or to create it anew so that this material can be manufactured in sufficient quantity for use in such an emergency. This situation not only is serious, hut actually is alarming.

"The Army Air Service should be large enough and adequately equipped so that it would be prepared instantly to meet any air force which an enemy might bring against us. The importance of the role which the air service will play in the defense of the nation should be thoroughly understood, and this component of the army should be increased to its proper strength. The air service then should have a definite procurement program which would insure proper equipment, replacements and a reserve supply of aircraft for use in an emergency and until war-time requirements could be met by increased production. Such a program would call for an annual expenditure of approximately $15,000,000 per year for the next five years. Thereafter this annual expenditure no douht could be decreased.

"In addition to this expenditure for new aircraft there would be required approximately $10,000,000 for operating the service.

Regarding industrial mobilization, Assistant Secretary Wainwright said in part:

"The problem is to insure, so far as foresight may provide, that our industrial estahlishments and factories may be prepared upon the outbreak of war to turn as rapidly as possible, from their peace time tasks to the production and operation of those things that shall have the primary call and preference upon their facilities for production. This call and the load so placed should he, however, so nicely adjusted that the essential needs of the people should be disturbed only so far as is necessary.

"But with munitions and aircraft and related supplies it is another matter. Here as well as elsewhere complex problems arise. The effort must be made to secure an acceleration of production to the utmost extent conformable with the size and rate of mobilization of man power."

Army May Get Z R-3

It is quite within the bounds of probabilities that the Army Air Service may be the recipient of the ZR-3, the reparations airship now approaching completion in the Zeppelin works.

The Navy will have its own airship, the ZR-1, expected to be completed in June, designed and built by Navy engineers. It will be stationed in the monster shed at Lakehurst, N. J.

The Army has the only other shed large enough to house either of these ships, at Belleville, Ill.

In the Summer of 1919 the Army initiated the first negotiations for a rigid German airship. In January, 1920, the Joint Army and Navy Board allocated the development of rigid airships to the Navy. Under the Treaty of Versailles the Navy was named as the procuring agency for the ZR-3, as the Navy has designated the craft.

However, the operation of an airship is not necessarily *development*. The Army has needs for a rigid ship apart from those of the Navy. The Army wants a rigid ship as means of transportation of personnel and supplies between stations and this country and, perhaps, between stations in this country and in its possessions. The Army Air Service wants to weigh by test the possibilities of the airship as an airplane carrier, taking off, landing, servicing and repairing on the airship. The airship is a long distance bombing and reconnaissance instrument with capahilities entirely different in extent from those of the airplane.

The Navy is charged with seaward reconnaissance. Were any combination of powers to attack from the Atlantic, it is possible the naval airships would be drawn to the Caribbean for the defense of the Panama Canal. The Army, had it no airships, would be helpless in aerostation.

The Army has other problems, peculiarly its own, in which the rigid airship figures. One can conceive that the Army has, perhaps, more uses for the rigid ship than has the Navy.

At any rate, without the weighing of respective claims that might he put forward in the event of rivalry in final acquirement, the rigid airship has its place in military aeronautics

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as in naval aeronautics and without a ship the Army can scarcely study its application to Army aeronautics.

As the ZR-3 is being built on commercial lines, there is the third possibility that, in the event a bureau of civil aeronautics is established, it may be operated by the bureau or by a civil agency under a special arrangement. Then there is the Post Office Department which may be a bigger contender, using the airship in transcontinental mail service.

New Airship Makes Successful Test Flights.

The new Army Airship D-2, recently erected at Scott Field, Ill., by the members of the Airship Class of the Air Service Balloon and Airship School, made its first test flight on Tuesday, February 6th. The test was successful in every way.

The ship was taken out of the hangar at 2 o'clock Tuesday afternoon, and was put into the air immediately. Flying at an altitude of 1,000 feet, the big ship circled the landing field and headed for Belleville, a nearby city. At this time communications were established between the ship and Scott Field by radio telephone, and conditions of the flight were sent down to Colonel C. G. Hall, Commanding Officer.

After the D-2 had been in the air a short time, the operator picked up K. S. D., the broadcasting station of the St. Louis "Post-Dispatch", and as each member of the crew had on a headset, everyone on board enjoyed the concert which was being broadcasted at that time. The ship returned to the field and was landed at 3:04 p. m., after being in the air one hour and four minutes.

The pilots of the D-2 on this flight were Lieut. H. H. Holland, in command; Lt. Arthur Thomas, direction, and Lt. Don L. Hutchins, altitude.

The second test flight of the D-2 was made on Feb. 8th, when, taking off the field at 9:55 a. m., the ship flew over Belleville, crossed the Mississippi, and circled back and forth over St. Louis, Mo. While over the city the ship's commander conversed with the operators of the broadcasting stations of the St. Louis newspapers over the radio. Reports from amateurs who listened in on the conversation are still coming in at Scott Field.

The airship returned to the field after a very satisfactory flight, and was put away in the hangar at 1:20 p. m. On this flight were Lieut. H. H. Holland, in command, Lieut. Arthur Thomas, direction pilot; and Lieut. Ira F. Koenig, altitude pilot.

The D-2 has a capacity of 190,000 cubic feet, is 198 feet long, 51 feet high, and 38 feet wide. It has a full cruising speed of 58 miles an hour and uses two Wright "V" type motors, developing 180 h. p. each. This ship has a useful lift of 4,140 pounds and can take up twelve persons under normal conditions.

It is expected that the D-2 will shortly be turned over to the Air Service Balloon and Airship School for use in instructing students in airship piloting.

West Pointers to Receive Training at Mitchel Field

Mitchel Field, L. I., New York, will have the honor of entertaining the 1924 Class of the United States Military Academy, when approximately 210 cadets are expected to arrive on June 13th. These cadets will remain for a period of two weeks, when they will be replaced by the balance of the class, consisting of about the same number. During the month to be devoted to this purpose about 420 cadets will have visited the station.

A syllabus of instruction is now being worked out to cover the visit of both groups. It is intended giving as an extensive and intensive course of instruction in the rudiments of aviation and the theory of flight as the limited time will permit.

It is realized that this Cadet class will have completed a year of intensive training, and therefore every effort will be made to make their visit pleasant and attractive in addition to being instructive. Numerous social functions are being planned, and arrangements are also being made for the comfort of the cadets' guests. Mitchel Field hopes to make their visit an event that they will long remember with pleasure.

Pursuit Airplane now Equipped for Long Flights.

An MB3A airplane at Selfridge Field, Mt. Clemens, Mich., has been equipped with a releasable gas tank containing 37 gallons of gasoline. This tank is suspended from the bomb rack under the fuselage. The releasing device is controlled from the cockpit. This added supply of gasoline will increase the flying radius of an MB3A to about 400 miles. The tank was designed by McCook Field.

General Mitchell Pilots A Flying Arsenal.

During his inspection of Kelly Field, San Antonio, Texas, General William Mitchell, with his aide, Lieut. Clayton Bissell as observer, piloted a plane from the Eighth Attack Squadron equipped with eight machine guns, demonstrating the practicability of operating this number of guns on one ship. A number of the attack squadrons at Kelly Field have been supplied with DH4B airplanes equipped with eight machine guns each, also with bomb racks.

Night Flying At Scott Field.

Some thirty large flood lights have been installed on the sides of the hangars bordering on the west edge of the landing field at Scott Field, Belleville, Ill. This was done in anticipation of the night flying in airships, which is scheduled to begin in a short time as part of the course of instruction in airship piloting.

Major Hickam's New Assignment

Major Horace M. Hickam, Air Service, who has been on duty in Washington, D. C., as Chief of the Information Division, Office Chief of Air Service, for nearly four years, has been transferred to Kelly Field, San Antonio, Texas, where he has assumed command of the Tenth School Group. He is also Assistant Commandant of the Air Service Advanced Flying School at that field.

It is doubtful if the transfer of an officer from this city to another station has occasioned such universal regret as in the case of Major Hickam. Always cordial and genial in disposition, his host of friends in Washington will surely miss him. We join them in wishing him every success in his new duties.

Major Hickam has been succeeded as Chief of the Information Division by Major Ira A. Rader who, prior to his new assignment, served as Air Officer of the 7th Corps Area with headquarters at Fort Omaha, Neb.

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REVIEW of WORLD AERONAUTICS

German Aviation Might be Reparations Penalty

French military aviation since the armistice has cost the nation 2,000,000,000 francs, and when a few years hence the motors now in use, taken from war stocks, must be replaced the aviation budget must be increased to at least 1,000,000,000 francs a year. Taking these figures as a basis, the Echo de Paris suggests France demand that Germany cease the construction of commercial aircraft, as another "productive guaranty," declaring that the sums thus saved for Germany not only would provide a huge economy for Germany, but would also enable the French budget to be materially reduced on account of the absence of costly competition.

The Biard-Supermarine Records

Four more World's Records, to the credit of Great Britain, have been officially granted by the F. A. I. for the performances put up by Capt. Biard, on the Supermarine-Napier flying boat, in the Schneider Cup Race last year. These records are for 200 kms., 100 kms., duration and distance.

London to Denmark by Air

The Instone Air Line, London, announce that negotiations are being completed with Det Danske Luftfartselskab, the managing director of which is Mr. Willy Woolf, for through air bookings from Copenhagen to London *via* Cologne. It is estimated that the new service, which, it is hoped, will be started in the early spring, will save 18 hrs. on the trip between London and Copenhagen.

The Speed Record of the Italian Flying Boat S-51

On December 28, 1922, before the representatives and the officials of the F. A. N. I., the pilot Passaleva made the tests prescribed to determine the speed record according to the F. A. N. I. rules, with the flying boat S-51.

The straight runs of a Kilometer were 12. In the case of several tests the rules allow to choose four of them providing that they are consecutive.

The times on the 12 runs were as follows:

1st Test	13	seconds
2nd "	13 1/5	seconds
3rd "	12 2/5	seconds
4th "	13	seconds
5th "	13	seconds
6th "	13 3/5	seconds
7th "	12 3/5	seconds
8th "	13 2/5	seconds
9th "	12 4/5	seconds
10th "	13	seconds
11th "	12 4/5	seconds
12th and last Test	13	seconds

To calculate the average speed the last four tests were chosen giving a total time of 51 4/5 seconds and 12 19/20 seconds on each kilometer run.

The average speed resulting from the time of the chosen tests is Km. 277,992 per hour (174 miles per hour).

In one of the tests owing to the favorable wind the speed obtained was more than Km. 280 per hour.

International Air Congress, London, 1923

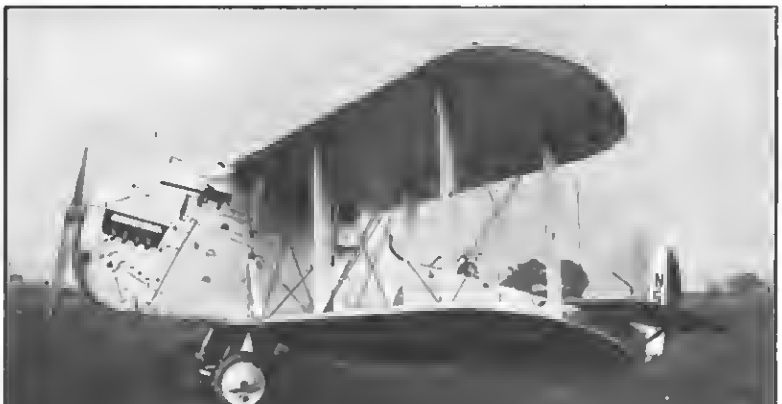
The Congress which is taking place in London on the invitation of the British Government, will be held from Monday, June 25th to Saturday, June 30th, 1923 inclusive.

The principal object of the Congress is to give an opportunity for international discussion of the various problems in connection with aircraft design, construction and operation. The papers to be read will be divided into 4 Groups which will hold Sessions simultaneously: A. Aerodynamics, Aeroplane Construction, Research Methods, &c.; B. Power plants, Fuels, Lubrication, Airscrews, &c.; C. Air Transport and Navigation; D. Personnel, Air Tactics and Strategy (as affecting Commercial design), Airship Design and Construction, &c.

An opportunity will also be afforded of visiting various British aircraft establishments and factories, and the Air Ministry have arranged to hold the Royal Air Force Pageant on June 30th, the last day of the Congress. Membership is open to nationals of all countries which are represented on the Federation Aeronautique Internationale or which are signatories of the International Air Convention. The subscription for Membership will be 1£ (or its equivalent in foreign currencies) while members of the family of a Member may join as Associate Members for a subscription of 10s. 0d. (or its equivalent). An Official Report of the Congress will be published and may be subscribed to for an additional 1£.

The official languages of the Congress will be French and English.

Lt. Col. W. Lockwood Marsh has been appointed General Secretary of the Congress and the official address is 7, Albemarle Street, London W. I., England.



Gunnery fleet spotter built by Blackburn Aeroplane Co. for the British Government. It is equipped with a Napier Engine

Aviation in Syria

The Syrie-Liban Aero Club, recently formed with the object of developing aviation in Syria, is to be affiliated with the Aero Club of France and a certain liveliness in aviation matters may be expected in this country in the near future. The French Air Service has already organized 50 landing stages, 10 of them fully equipped as regards shelters, revictualling and repairing arrangements.

The principal lines thus prepared are Alexandretta, Aleppo and Deir-ez-Dor, on the route to Bagdad; Aleppo, Hama, Homs, Rayak, and Damascus towards Palestine and Egypt; Damascus, Palmyra and Deir-ez-Zor for the direct crossing of the Syrian desert in four hours; Alexandretta, Latakia and Tripoli for the coastal line.

Spanish Activity

Authorization for the purchase of large quantities of aeronautic equipment by the Spanish Government was granted on November 20th. The specifications called particularly for spare parts for the Bristol, the DeHaviland, and various French planes. Airdrome equipment is also to be purchased, including installations at Cuar to Vientos, Getafe, Los Alcazares, Leon, Granada, and several airdromes in Africa. Two Breguet airplanes, with ambulance equipment, were ordered by a separate decree. Apparatus for airplane photography was also purchased from a German firm, one set at a cost of 50,000 pesetas and another at 67,000 pesetas.

It is reported that there is still a considerable sum to be spent from the appropriations in order to prevent the money from reverting to the treasury, which is considered undesirable.

Argentina Air Mail

By arrangement with the Aerial Transport Co. of the River Plate, the Argentine Post office has established a daily air mail service between Buenos Aires and Montevideo, the planes to carry passengers as well as mail. Three hydroplanes will be used, and the flying time will be about one hour.

In addition to the regular postal rate, letters and newspapers will carry a surtax of 30 centavos for each 20 grams or fraction thereof; on books and similar printed matter the surtax will be 30 cen-

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tavos for each 65 grams. One of the planes to be used is already on hand, and the service should be in operation by the first of the year.

The Progress of Civil Aeronautics in Italy

(Special to Aerial Age)

The present situation of aeronautics in Italy is not easy to explain.

The recent abolition of the "Comando Superiore d' Aeronautica" which up to the present has acted as Air Ministry, is a step forward in the reconstruction of Italian Aeronautics, and it is hoped that the measures taken by the new cabinet will put Italian aviation in line with the other nations. But this, of course, is only a beginning.

Italy has never had an air policy. She has always "muddled through" without a policy. Manufacturers were not aided nor were private ventures encouraged. Subsidies were always very small and seldom granted with sound judgment, resulting in the formation of a lot of small firms without sufficient resources or capital, to the detriment of companies already engaged in the manufacture of planes.

Aeronautical propaganda, moreover, is neither sufficient, nor intelligently constructed. The Italian press makes no attempt to support a domestic industry.

As to the aircraft industry for civil purposes, this is chiefly devoted to the transformation of military types into commercial machines. And finally if we add that commercial machines are not reliable and that material prices are unusually high, you will have an idea of the confused situation of Italy's aeronautical industry.

The National Aeronautical Corporation

As affairs stand it is not difficult to understand that an unique organization is required for the stablization of civil aeronautics. This organization is the National Aeronautical Corporation which has the support of the Fascisti Party.

The C. N. A. "National Aeronautical Corporation" already comprises the largest and most reliable organization in Italy.

The possibilities of such a Corporation depend on the extensiveness of the resources which every incorporated society must have, and on the likelihood of coordinating the advantages to be gained thereby.

This corporation will incorporate the firms shown hereunder:

COMPAGNIA NAVIGAZIONE AEREA, Ltd., established 1921—devoted to the exploitation of national and international air lines with aeroplanes, hydroplanes and airships. Their managers think of starting international lines plying between Central Europe, the North African Continent, the Balkans and especially South Russia, Ukraine and Caucasia. These countries, rich in raw-products and in goods of every kind, are comparatively near from the geographical point of view but practically far owing to the slowness and uncertainty of the existing means of transportation. Lines based on these geographical and economic fundamentals should pay their own way today and reap tremendous benefits in the future. In this connection we must consider that aerial navigation is not yet in such a position as to meet the competition of the other means of transportation, for the advantageous coefficient "speed" is superseded by the coefficients "danger" and "cost". Consequently in the manager's opinion, every line operating in competition with steamers or railways is, generally speaking, unprofitable and unimportant. The air lines operating over the Nice-Athens and Rome-Milan routes, for example, we would expect to find in precisely such a condition.

COMPAGNIA NAZIONALE AERONAUTICA (formerly Coöperative Nazionale Aeronautica), established 1920. Starting, organization and exploitation of flying fields; aeronautical instruction, flying school, pilots' training, pleasure trips, aerial photography, aerial advertising, are some of the branches of the aforementioned company. The first thing for this society to do is to supply the country with flying fields. These are to be taken over from the military administration, for the exploitation of the fields must be a civil service and bear a commercial atmosphere. The government, moreover, must help the aeronautical schools.

L'AREA—Aeronautical Information Agency, established 1922. As the greatest part in popularizing aeronautics is being played by the press, this agency issues one or two bulletins daily which are sent free of charge to all the newspapers and agencies of Italy and foreign countries. The Italian press has welcomed this movement favorably and is accustomed to go to the "Area" for its aeronautical information.

PEGNA BONMARTINI CERRONI—Naval and Aircraft Manufacturing, open partnership established 1922. This is the only firm in Italy devoted to the construction of new types of machines, especially for civil and commercial purposes. Though it is the youngest Italian aircraft firm, it is having a very large share in Italian aeronautics, not only because the designer of the well known PRB Flying Boat is its manager, but because it is working in partnership with the National Aeronautical Corporation. The construction of newest types of military machines was recently awarded to it by the Ministry of War.

NATIONAL AERIAL BANK (to be established). The Count Giovanni Bonmartini, an Italian Pioneer, is the promoter of this bank which has the full approval of the Italian aeronautical world. We gather this information from the pamphlet issued by the Count Bonmartini.

The author, who can call himself an expert in this matter, does not approve of the foreign systems of subsidising aeronautical companies. In his publication he has pointed out that subsidies undermine organizations, engender speculation, put the government to a real expense and do not help the progress of aeronautics. This being the case, the government might form a bank from which important national companies could borrow funds when necessary. Such a loan should carry no interest for the first ten years, after which date interest should be very low and afterwards progressively higher.

By granting these loans the government would not *lose* money as other nations do under the system of subsidies. The government should grant an adequate subsidy only for the postal air service.

These are the general bases on which the bank in question is to be formed. Other interesting details are dealt with by the author in his publication (1) especially with regard to the banking operations.

An aviation Insurance Society should be allied to this bank, insurance being compulsory for all aeronautical parts and materials.

Alighiero Baciocchi

Race Around England to Be an Annual Event

The Royal Aero Club of Great Britain has received notification from the King that he will present a cup for the air race round England this year.

The race for the King's Cup was inaugurated last year when the King gave practical expression to his interest in aviation by presenting a trophy to be competed for in a race round Britain. The regulations for the contest were drawn up and the race was generally supervised by the Royal Aero Club, which received valuable assistance from the Air Ministry.

In the past year the race was won by Mr. F. L. Barnard, who flew a DH4A (Rolls) airplane, entered by Sir Samuel Instone. It is understood that the second cup which the King has now given will be competed for annually, the first being retained by the winner of the race last year.

The Italian Savoia S51

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Two Efficient Models by Bertram Pond.

THE two tractor models, illustrated in the accompanying line drawings, are representative of Mr. B. Pond's ability as a light-weight tractor designer. Altho many of the other Illinois Model Aero Club members are expert at building successful models of extreme light weight, the two shown, more particularly the indoor tractor, are among the most noteworthy.

The indoor tractor has remained in the air, during a contest, for 170 seconds. The speed in flight is about equal to the rate the average person walks. The slow speed and long duration are not due only to the use of balsa wood for the frame and propeller, but also to the builders knowledge and experience in balancing the machine properly. The summary of weights is interesting:

Rubber elastic	6/100 ounce
Motor base	5/100 ounce
Propeller	3/100 ounce
Wing	5/100 ounce
Total....	19/100 ounce

The wings have a total area of 62 square inches, so the loading is therefore .441 ounces per square foot.

Only two strands of one-eighth inch rubber are used. The propeller was given 1125 initial turns its record breaking flight.

Light tissue paper covers the wings and tail surfaces. No dope is used. Bamboo frame work. The propeller is 12 inches in diameter and very thin in section. Amberoid cement is used in making all joints and for attaching the propeller shaft to the propeller.

The skid shown in dotted outline on the drawing shows a suitable arrangement for rigging the machine for rising off the ground.

Ponds Hollow Spar tractor, also shown in one of the drawings holds the unofficial distance and duration records of 6,300 feet and 522 seconds. Officially this model is credited with a distance flight of 2,465 feet.

Weight specifications are as follows:

Total weight	1.47 ounce
Weight of motor base & fin	.35 ounce
Weight of wing clips	.27 ounce
Propeller weight	.15 ounce

The dimensions are given on the plan drawings. Six strands of 3/16 inch flat rubber are used for motive power. From 800 to 1200 turns are given the propeller.

Additional details of these machines were given in the August 1922 issue of AERIAL AGE. All letters concerning these two record-breaking models should be addressed to the designer, M. Bertram Pond, Illinois Model Aero Club, Auditorium Hotel, Chicago, Illinois.

RECENT ACTIVITIES OF THE A. E. S.

The Aeronautical Engineering Society at the Massachusetts Institute of Technology has held several meetings during the present school year. An account of the first, held Nov. 15, 1922, has already been sent to AERIAL AGE. The speakers for this meeting were Otto C. Koppen and Harry C. Karcher of the Society's glider team, and Prof. E. P. Warner. Motion pictures of last summer's gliding competitions in France and Germany were shown.

On Dec. 6, an informal conference on motors was held in the R. O. F. C. Air Service room at M. I. T., where over a dozen airplane engines of the leading types were on exhibition. The speaker for the evening was Mr. Warren Noble, chief engineer of the Kinney Manufacturing Co. of Jamaica Plain, Mass., which is developing new types of aeronautical engines for the U. S. Navy. Mr. Noble discussed in considerable detail many of the problems met in developing new motors, pointing out how particular difficulties had been discovered and overcome. Following Mr. Noble's talk, those present had an opportunity to ask questions and to join in an informal discussion of aviation engines.

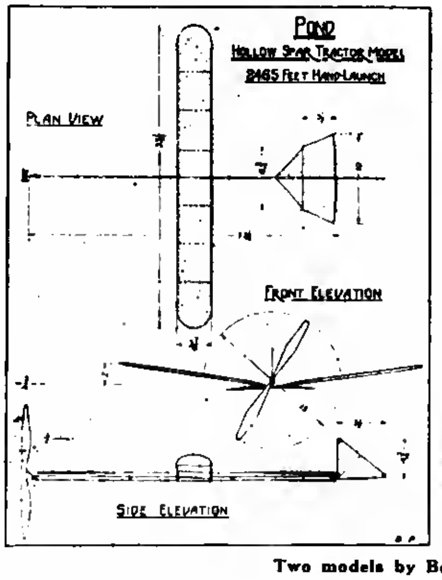
The first meeting this year was held on Jan. 11. The speaker was Prof. L. S. Marks of Harvard University, author of "Airplane Engines." Prof. Marks spoke on the subject "Supplying Fuel to Aeronautical Motors," with special emphasis on carburetor and manifold design. This was followed by an informal discussion of the subject among members of the Society and Prof. Marks.

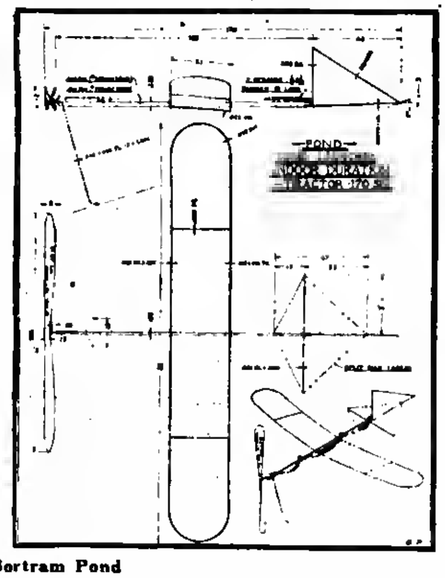
A meeting open to all M. I. T. students and the public, was held Jan. 25. The first speaker was President S. W. Stratton of the Massachusetts Institute of Technology, who, until recently assuming the presidency of the Institute was a member of the N. A. C. A. and Chief of the Bureau of Standards, which bureau was first organized by him and owes its present position of importance very largely to his efforts in developing it. Pres. Stratton spoke on his work in the N. A. C. A. and the Bureau of Standards in connection with aeronautics.

Pres. Stratton introduced Major General Mason M. Patrick, Chief of Army Air Service, who was the speaker for the evening. Gen. Patrick opened his address by giving a short history of aviation, and went on to tell of the accomplishments of the Air Service during and since the war, and the developments which are being carried on at present. He pointed out the important part played by airplanes in war, stating that the result of any future war would depend very largely upon the effectiveness of the Air Service, upon which, both land and naval activities are dependent. He described the Air Service flying tanks which are armored against machine gun fire and capable of carrying large caliber non-recoil cannon. Mention was made of the new dirigibles which will be able to fly to the north pole and back, and can be used to transport troops and supplies and even small fighting planes which can drop from the mother ship to engage in combat, and then return to her, being picked up by hooks suspended from her keel. Moving pictures of bombing tests, taken from the bombing planes themselves, were thrown on the screen, showing operations against battleships.

The second part of Gen. Patrick's talk was on helicopters. Moving pictures were shown of several types in flight, which showed them to be decidedly unstable. The official Air Service films of the new de Bothezat helicopter which recently made a record flight at McCook Field, were thrown on the screen. These pictures, which had been shown only once previously, showed the remarkable stability of the machine, which flew with apparent ease.

The next speaker was Prof. E. P. Warner who spoke on the "Operation of Commercial Air Lines." His talk was a detailed summary of his observations while travelling thru Europe last summer making a study of European airways, on which he flew some two thousand miles. His talk was illustrated with moving pictures and lantern slides showing the equipment of airplanes and air ports abroad. Prof. Warner explained the steps which are necessary before passenger lines can





Two models by Bertram Pond

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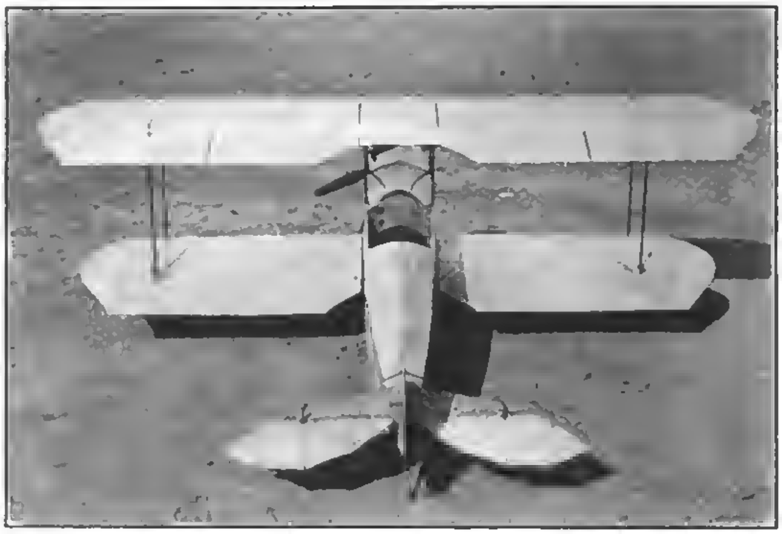
be operated successfully on a large scale in this country, and pointed out the promising future which lies open to commercial aviation once these steps are taken.

Several reels of motion pictures of the glider contests in Europe were thrown on the screen showing the M. I. T. gliders, which were built by the Aeronautical Engineering Society, in flight. Some of the films had just arrived from Europe and were shown for the first time in this country. These pictures concluded the program for the evening.

The A. E. S. is conducting a glider design competition open to all students at M. I. T. This competition is similar to the one held last year by the Society, and it is expected that the winning design will actually be built, although it has not been determined whether or not the Society itself will undertake the construction.

With the consent of Prof. Warner, the Society has had several complete sets of photographs printed which were taken by Prof. Warner at last summer's gliding meets in France and Germany; and has offered these photos for sale. Several hundred have been sold so far. These photographs show all the prominent gliders taking part in the contests, most of them in flight. The set of photos forms a very complete pictorial record of the gliding meets.



The Houpizine constructed by Clarence Melton

Melton's Houpizine

Now that the old flivver has taken to the air we may be able to fly around a bit without waiting for the millennium municipal and landing fields. Mr. Melton, Clarence to be exact, of 3507 East 34th St., Kansas City, Mo. has bone and did it. Here is what an automobile mechanic did—Mr. Melton—in his spare time, doing the work himself including the welding and the woodwork. He took a Ford engine, turned it end for end to deceive Henry, mounted a home-made prop, disposed it in the bow of a fuselage, added some wheels and at last a pair of wings, and it flew—just like a regular aeroplane designed by Bothezat or Willard or Shaw or anybody. Some Army officers flew it and reported a very fair performance or at least as good as could be expected outside of McCook Field.

Here is the dope. The power plant is a remodeled Ford engine, in which a 16-valve head was substituted. The flywheel and transmission were removed and an airscrew placed where the transmission originally was. Ignition is by a Dodge magneto supported on a shelf to the rear of the engine. The throttle is operated by a simple direct-connected wire extending from the carburetor bell crank through the instrument board and terminating in a small button. The fuel consumption is 3 gallons per hour. The airscrew of 6.5 ft. diam. by 3.5 ft. pitch furnishes 275 lbs. thrust.

Following are the general characteristics: Upper span 20 ft. lower 18 ft.; Chord 4 ft. 4 in.; gap 4 ft. 4 in.; stagger 10 in.; sweepback, lower, 3°, upper, 0°; dihedral, very small in lower wing; total supporting surface 167 sq. ft.; flying load 4.5 lbs. per sq. ft.; 18 lbs. per h.p., loaded with pilot; maximum speed 72 m.p.h.

(*Concluded from page* 186)

by the government with other means of transportation *at such rates that passengers and merchandise can be attracted to aerial lines.*

As soon as it is possible to do so, let us sell on easy terms to privately owned aerial operating companies, under proper guarantees, *with* or *without* a contract for carrying mail, the lines that we have started and let them make it their business to see that they pay dividends to the stockholders, *with as little government interference with the conduct of their business as it is possible.*

Let us keep in mind that if we want to have military pilots and good aircraft in time of war we must have good civilian pilots and a flourishing aeronautical industry in time of peace. We do not want to spend more than we have to for military and naval aeronautics in time of peace if we can create the great school of commercial aeronautics for our pilots and a powerful organization of aircraft manufacturers that will turn out military and naval aircraft in time of war just as so many Ford cars.

Gentlemen, this can be accomplished by you with the power that has been conferred upon you by the people. It is up to you to decide if we are going to compete with European nations in the mad race for aerial armaments or else if we are going to create a great industry that will enhance our commerce in peace time and will enable us to protect our land from any possible foreign invasion in time of war.

It is also up to you to take the responsibility of doing nothing for aeronautics which has been the unfortunate record of the Sixty-seventh Congress.

We propose to do our duty by presenting to you, and to the people at large, facts, suggestions and constructive criticisms and we request your action which we confidently expect will not be delayed any further.

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$5000 in Prizes for Users of Valspar

Nearly everybody knows about Valspar and millions are using it. This wonderful waterproof varnish has proved its worth and quality under circumstances and conditions that are nothing short of amazing.

Thousands of unsolicited letters have reached us from people wishing to relate unusual Valspar experiences. These letters furnish overwhelming testimony of Valspar's marvelous durability and its astonishing resistance to water, heat, acids, alkalis.

And we are convinced that thousands of other Valspar users have had experiences just as interesting. We want to know of these incidents. Accordingly we are offering several thousand dollars in cash prizes for letters telling of experiences with Valspar.

List of Prizes

Prizes for Valspar Experiences
1st prize $500.00
5 prizes of $100.00 each
10 prizes of $50.00 each
100 prizes of $10.00 each
200 prizes of $5.00 each
316 prizes in all—Total value of prizes $3,500.00

Prizes for Valspar Dealers
1st prize $250.00
5 prizes of $100.00 each
5 prizes of $50.00 each
10 prizes of $10.00 each
80 prizes of $5.00 each
101 prizes in all—Total value of prizes $1,500.00

Contest Closes April 30th

VALENTINE'S VALSPAR
The Varnish That Won't Turn White

For Instance

That you may understand exactly what we have in mind, we give the following actual experiences as examples:

1. C. K. Perry of Marshfield, Oregon, wrote about a Valsparred dining room table which as the result of a fire last July, was drenched with water mixed with lime and charcoal. The under part of the table (which was not Valsparred) turned white as snow—the Valsparred top, when washed, was found to be in perfect condition.
2. Mr. J. H. Audibert, of Fort Kent, Me., varnished four axe-handles, each with a different Varnish-Stain including Valspar Varnish-Stain. He writes: "The cheapest stain looked all right and dried quicker, but after putting all the handles in a pail of ashes mixed with boiling water, I found the Valspar was the only one that stood the test."
3. One stormy day last November, Mrs. J. B. Kirk of Hackensack, N. J., had to leave her car out in the driving rain and sleet. (Fortunately, her husband had put two coats of Valspar Enamel on it the Spring before.) "After the storm," she writes, "it looked like an iceberg and I thought the finish would be ruined. But the ice and water didn't hurt it at all and today the car looks as fine as when the enamel was first put on. Our garage man marvels at it, because his own car, which he refinished with another make of varnish, looks so shabby and dull."

Unique Qualities of Valspar

Valspar is made in three forms—Valspar Clear Varnish, Valspar Colored Enamels and Valspar Colored Varnish-Stains. All of these can be freely washed with hot water and soap; they never turn white; they resist the action of acids, alkalis and oils. They are very durable; they don't chip, crack or peel. They dry in any weather—dust-free in two hours and hard in twenty-four.

About the Uses of Valspar

Clear Valspar is, of course, used for finishing floors, all kinds of indoor and outdoor woodwork, furniture, boats, refrigerators, linoleum, and for the many other uses of varnish.

Reg. U. S. Pat. Off.

The famous Valspar Boiling Water Test

Valspar Varnish-Stains possess the same qualities as clear Valspar, but you stain and varnish with one stroke of the brush. They come in six permanent colors. Absolutely waterproof and very durable, they are unequalled for finishing floors, front doors, porch furniture, and all other woodwork that requires staining.

Valspar Enamels answer the need for a really waterproof enamel. They are made from the finest pigments carefully ground in clear Valspar, thus combining Valspar durability with exceptional beauty of color. Valspar Enamels are absolutely unsurpassed as an automobile finish and for wood, metal and all other surfaces where enamel is used. They come in 12 standard colors.

What Can You Tell Us?

If you know an instance where any (or all) of these three forms of Valspar has proved its durability and waterproofness under unusually severe conditions of wear, or under some extraordinary circumstance, we ask you to write us about it. And if you have photographs which add interest to your story we will be glad to receive them.

It makes no difference which form of Valspar has been used—it makes no difference what kind of a Valsparred surface it is. Just tell us the facts.

Requirements and Prizes

There are no restrictions, no intricate qualifications. Write your letter in ink and use *only one side of the paper*. These are the only requirements—with the understanding, that the incident told about actually occurred prior to the first announcement of this contest. And that we shall be allowed to use for publicity purposes as we see fit any letters submitted.

$500 will be awarded to the contestant who sends the letter that the judges agree is the most interesting of all. 5 prizes of $100 to those whose letters stand next in interest—ten $50 prizes, one hundred $10 prizes, and two hundred $5 prizes will also be distributed—more than three hundred (300) prizes in all.

The judges of the contest will be Mr. Lawrence F. Abbott, President of The Outlook; Miss Martha E. Dodson, Associate Editor of The Ladies' Home Journal; Miss Gertrude B. Lane, Editor of the Woman's Home Companion.

We suggest that letters do not run more than 250 words in length, but length or literary style will have no bearing on the award of prizes.

All letters must be received by April 30th.

Address your communications to Valentine & Company, Prize Contest Department, 51 East 31st Street, New York City, N. Y.

Write Your Experience Now

Let us hear what you know about Valspar. Don't consider your experience as too trifling or commonplace, write us about it. Not everybody can relate a startling occurrence, and it's more than likely many of the prizes will be won by simple, matter-of-fact stories.

Don't let this chance slip by. A few minutes spent in writing your letter gives you a splendid chance to win a substantial prize. Send us *your* story. Send it today.

Prize Contest Department
VALENTINE & COMPANY
51 East 31st Street, New York

Every Live Dealer in the United States Sells Valspar

SPECIAL DEALER WINDOW DISPLAY CONTEST

In addition to the contest described above, which is open to everyone, including all dealers, there will be a special contest for dealers only.

$1500 IN PRIZES for photographs of the best Window Displays of any or all of the following—Valspar, Valspar Varnish-Stain and Valspar Enamel. Only those dealers who have Valspar in stock or have ordered same at the time of the first announcement of this contest are eligible.

Prizes will be awarded as follows: First prize $250; 5 prizes of $100 each; 5, $50 prizes; 10, $10 prizes, and 80, $5 prizes—101 prizes in all. All letters and photos must be received by April 30th, 1923.

Save this page—and work for a prize

AVIATION

Big Pay *Opportunity* *Success*

AIRPLANE EXPERTS EARN $2,000 to $10,000 A YEAR

Aviation to-day offers the most wonderful opportunities the world has ever seen. The marvelous growth and development of Commercial Aviation has created an unheard of demand for men who are trained in some branch of this great industry. A demand for Airplane Experts.

$40.00 to $200.00 A WEEK IS EASY

Capable mechanics, Engineers, draftsmen, designers, constructors, inspectors—men who may be classed as Airplane Experts earn $40 to $200 a week—even the "screw-driver" mechanic makes big money today.

BE AN AIRPLANE EXPERT

NOW is the time to qualify. Let me train you in your spare time at home. I train you in modern methods of design, manufacture, operation and maintenance, fitting you to hold down a good job in Aviation as an Airplane Expert. My course in Applied Aeronautical Engineering has placed hundreds of men in Aviation—on the road to success—why not you?

FREE AIRPLANE PARTS

Because my course is the most practical method of instruction by mail ever devised, you must work with actual airplane tools, wires and fittings in your *own home*, with your *own hands*. You learn and apply theory, design and construction on an actual experimental airplane built to scale—not a toy. This wonderful outfit is absolutely free.

MONEY BACK GUARANTEE

So sure am I that I can make you an Airplane Expert capable of earning big money I absolutely guarantee to pay you back every penny if you are not entirely satisfied with my instruction.

MAIL THE COUPON NOW

Let me send you my illustrated booklet and show you how easily you can qualify for a "man's size" job in Aviation. Mail the coupon NOW to

L. B. Coombs, Chief Engineer

THE CENTRAL AIRPLANE WORKS, 3254 Lincoln Ave., Chicago

L. B. Coombs, Chief Engineer 3254 Lincoln Ave. Chicago, Ill.

Dear Sir: Kindly send me free of charge your booklet on Aviation and tell me how I can become an Airplane Expert.

NAME____________________

ADDRESS____________________

Service and Prices Both Important

10c or $10,000.00 it makes no difference. Regardless of size your order will receive the kind of service that only years of experience in this business can give. You can depend on us for Quality, Service, Satisfaction.

Propellers for 0X5

Make	Wood	Copper Tipped	Type	Diameter	Pitch	Price
Suffalo	Mahogany	"	Toothpick	6'4"	5'3"	$15.00
Flottorp	Birch	"	Toothpick	8'4"	5'	20.00
Flottorp	Birch	"	D-5000	8'	5'3"	20.00
American	Oak	"	Toothpick	8'4"	5'	15.00
Paragon	Oak	"	"	0'3"	5'	15.00
Liquid Carbonic	Birch	"	"	6'	4'	15.00

Radiators for 0X5

Roms Turney, square core weighs 56 lbs.	15.00
Mayo, square core weighs 50 lbs.	15.00
Barrison, cartridge core weighs 44 lbs.	15.00

These radiators are new and guaranteed to cool an OX5. They have connections for thermometer.

Instruments

Oil gauges, O-120 lbs. luminous dial	$ 2.50
Air gauges, O-10 lbs. luminous dial	2.00
Altimeters, Taylor, 3½" luminous dial, O-25000 ft.	3.00
Altimeters, Zenith, 3½" luminous dial, O-28000 ft.	3.50
Compass, G. E. Army type	15.00
Inclinometers, Taylor or Elliott, bubble type	2.00
Tachometer Heads, Jones, Johns Manville, Warner, NCR	5.00
Tachometer Heads, French "Jaeger," with short shaft	5.00
Tachometer Heads, for German motors	3.00
Tachometer Head, for English motors	5.00
Thermometers, Boyce distant type, 15' tube	7.50
Hand Air pumps, brass barrel	1.00

Write for our No. 5. Price List and tell us how we can serve you better.

JOHNSON AIRPLANE AND SUPPLY CO.

The Aeronautical Supply House

DAYTON, OHIO

$100.00 A Day as an Income Tax Consultant is not unusual and hundreds are paid $25.00 to $50.00 per day. Our Course in Federal Tax Accounting will help you attain such a position. Write The Walhamore Institute, Lafayette Bldg. Phila. Pa. Dept T.

$3,000 to $25,000 are the salaries paid to leaders of big business—you study their methods through our Course in Business Administration. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept B.

$5.00 An Hour represents the regular charge of the Advertising Writer and Specialist. There's a Walhamore Course in Advertising for you. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. A.

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$200 A Day For A Little Poem is said to be Walt Mason's daily income. Our Course in Newspaper Correspondence and Journalism tells you how its done. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. J.

$10,000 A Year As A Salesman. Earned by many. Study the subject and join the ranks. Write the Walhamore Institute, Lafayette Bldg., Phila., Pa. Dept. S.

$5,000 or more as a Mail Order Merchant may be earned in your own home or store. Write The Walhamore Institute, Lafayette Bldg. Phila., Pa. Dept. MO.

Quality Speed Bargains

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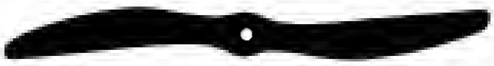

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Aerial Mapping By the Geological Survey

AMERICA TO CALL WORLD CONGRESS ON AERONAUTICS

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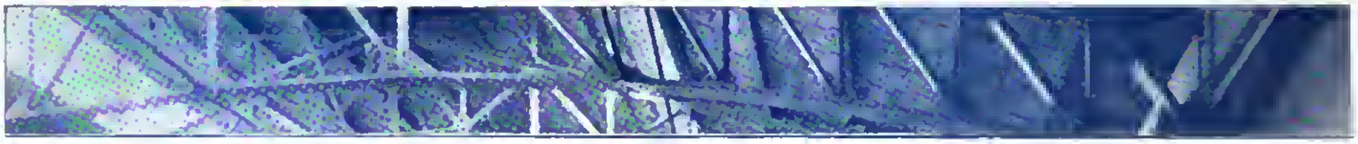

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TABLE OF CONTENTS

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National Headquarters 26 Jackson Place Washington, D. C.

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Do you believe with the Engineers, Economists, and Statesmen, that the advancement of civilization depends npon the development of transportation and commnnication?

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Official Photograph U. S. Navy

The C-7 helium-filled Navy blimp salutes the White House when passing over Washington

Official Photograph U. S. Navy

Remarkable aerial photograph of the Pacific Fleet Destroyers laying a smoke screen with the "eyes of the Navy" the F-5-L's of the Pacific Air Force, watching high above

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U. S. Destroyers laying a smoke screen, as seen from the air

AMERICA TO CALL WORLD CONGRESS ON AERONAUTICS

THE National Aeronautic Association of the U. S. A. has decided to call an international conference of scientists, engineers and technical men interested in aeronautics and manufacturers of aircraft and accessories for the purpose of reaching a world understanding in research work and the technical side of aeronautics. The conference will be held in the United States, probably in Washington and before the close of this year, under the auspices of the National Aeronautic Association, which represents in America the Federation Aeronautique Internationale, whose headquarters are at Paris.

In inviting representation from all nations it is believed that aeronautics has now reached such an important stage of development that the cordial coöperation of all countries interested in the solution of outstanding problems must be secured. Emphasis is laid on the purpose of establishing through personal contacts in a World Congress a better spirit of interest and understanding for world progress in aeronautics.

The progress of commercial aviation in the United States and all other countries, according to an announcement of the National Aeronautic Association, depends in a very great degree upon the closest relations between scientists, engineers, technical men and the manufacturers for the purpose of solving the many technical problems that are interwoven with aerial transportation.

Aeronautics is not only a national proposition connected with the defense and the commerce of any one country, but it is largely an international proposition. It interests the people of the world because it opens up a new and tremendously important field of activities in the transportation of passengers and merchandise all over the world. For these reasons the National Aeronautic Association believes that all obstacles which are at present hindering the fullest development of aeronautics should be removed through the active coöperation of all concerned. General interest in standardization because it will enhance reliability and safety is more widespread than ever as a result of the membership campaign throughout the country of the National Aeronautic Association, which is enrolling in every state men and women who are confident that the United States can and will take the lead in aerial transportation.

One of the main obstacles today is the lack of uniform standards in the scientific field of aerodynamics and in the engineering end of aircraft design and construction. In research work the difference in languages in the various countries is further aggravated by a very serious lack of agreement on the interpretation of the results obtained by the aeronautical research organizations throughout the world. This has resulted in confusion as to the meaning of symbols, definitions, methods of graphic

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representation, etc. and has prevented students and aeronautical engineers from benefiting to any appreciable extent from the work done in the scientific and technical field of aeronautics outside their own country.

Upon the adoption of standards depends in very great measure the element of safety in air transportation. It also has an important bearing upon the construction and operation of aircraft. The National Aeronautic Association anticipates that in calling an international conference it will have the hearty support of representatives of the various engineering organizations and the aircraft manufacturers of the United States and of the chiefs of the government departments utilizing aviation, who will recognize that through such a congress the desired results may be obtained in the shortest possible time and by an interchange of ideas and experiences among those delegates who attend the sessions.

William Knight, vice chairman of the Scientific Research and Industrial Relations Committees of the Association, will be actively in charge of the preliminary arrangements for the conference. Mr. Knight has been technical assistant in Europe to the National Advisory Committee on Aeronautics, and during the war was attached to the technical section of aviation of the American Expeditionary Forces in France.

NATIONAL CAMPAIGN TO ORGANIZE AERIAL FORWARD MOVEMENT

THE urgency of action which brought together a large and representative group of forward-looking Americans at Detroit last October, culminating in the creation of the National Aeronautic Association of the U. S. A., pledged to a comprehensive, definite and continuing policy of aeronautic development in this country, has in five months spread from coast to coast. It is already demonstrating a national sentiment. This was quickly recognized by the press and today newspapers everywhere are doing their patriotic part in overcoming a general bewilderment that was a natural result of the tremendous spur given aeronautics in the romantic and startling accomplishments of the World War.

Americans are learning that aviation adjusted to everyday needs must in time of emergency form the vital background for military-naval plans for the national defense, and the attitude of Federal, State and municipal authorities is rapidly changing from one of indifference to genuine anxiety to cooperate in the nation's aeronautic progress along sane and constructive lines. This growing national sentiment, however, in order to make itself a power to bring into being the fullest use of aerial equipment has required the co-ordinating influence of organization.

Confident that throughout the country there is a powerful demand for stable and immediate commercial progress through this newest and fastest of transportation facilities, the National Aeronautic Association has organized a complete field staff in nine districts, which are coextensive with the nine Army Corps areas of continental United States. This staff will on May 14, begin an intensive campaign everywhere to enroll members in the association with the goal set at 50,000 by June 1.

The campaign organization in each district is in charge of a chairman, whose prominence is representative of the character of both the association and of its membership. There will be chairmen for every State and subdivisions of each State, so that all communities will be canvassed to enroll those citizens who realize that if this country is to hold its own in the realm of aerial travel and transportation it has got to do it itself through the influence exerted by a cohesive body of public-spirited men and women.

Every person in step with the trend of the times knows the value of organization for awakening and informing the public mind. Strength in this great movement will come from the individual in alliance with the large body of progressive coworkers striving for the realization of America's aeronautical superiority. Thus the appeal to join the association has already brought responses from men and women in all parts of the country and the enrollment campaign is expected to result in the attainment of the 50,000 national quota —and more.

Active in the association and endorsing the membership campaign are the Hon. Melvin M. Johnson, Boston; Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge; Godfrey L. Cabot, President Aero Club of New England, Boston; Hon. James Hartness, ex-Governor of Vermont; Col. Edgar S. Gorrell, President Boston Marmon Co., Boston; Richard F. Hoyt, of Hayden, Stone & Co., New York; John D. Larkin, Jr., general manager Larkin Co., Buffalo, N. Y.; Major Loring C. Pickering, North American Newspaper Alliance, New York; Otto Praeger, former second assistant Postmaster General, New York; Arthur Woods, former Police Commissioner, New York; Col. B. F. Castle, Irving National Bank, New York; Dr. Joseph Ames, Baltimore, Md.; Rear Admiral W. F. Fullam, U. S. N., retired, Washington; W. F. Roberts, Bethlehem Steel Co., Sparrows' Point, Md.; J. S. Steinmetz, Aero Club of Pennsylvania, Philadelphia; B. H. Mulvihill, president National Gas Conservation Co., Pittsburgh; W. T. Anderson, editor "Telegraph," Macon, Ga.; Major James Meissner, Birmingham, Ala.; Charles A. Moffett, president Gulf States Steel Co., Birmingham, Ala.; Alfred W. Harris, Cleveland, O.; C. F. Kettering, chairman Ohio Aviation Commission, Dayton; Orville Wright, inventor of airplane, Dayton, O.; Glenn L. Martin, president Glenn L. Martin Co., Cleveland; B. M. Outcalt, Cincinnati; Frederick Patterson, National Cash Register Co., Dayton, O.; Howard E. Coffin, vice-president Hudson Motor Car Co., Detroit; Bion J. Arnold, chairman Chicago Air Board, Chicago, Ill.; C. Goodloe Edgar, chairman Aviation Committee, Board of Commerce, Detroit; Samuel M. Felton, President Chicago and Great Western Railway Co., Chicago; W. P. MacCracken, chairman Aviation Committee, American Bar Association, Chicago; Sidney D. Waldron, consulting automotive engineer, Detroit; Ralph W. Cram, editor "Democrat and Leader," Davenport, Iowa; Joseph Pulitzer, president Pulitzer Publishing Co., St. Louis; H. H. Bullen, American Steel & Wire Co., Denver; Dr. Frederick Terrell, banker, San Antonio, Texas; Edgar C. Tobin,

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member of Lafayette Esquadrille during the war, San Antonio, Texas; Hon. Ben. W. Olcott, former governor of Oregon; Cecil B. DeMille, director-general Famous Players-Lasky Corp., Los Angeles, Calif.; Lieut. Col. W. Jefferson Davis, Los Angeles, Calif.; P. G. Johnson, president Boeing Aircraft Corp., Seattle, Wash.; Sydney S. Bibbero, Banker, San Francisco, and many others.

President Coffin also has received strong endorsement of the aims and purposes of the association in the acceptance of appointment as governors-at-large by Major Gen. Leonard Wood, governor general of the Philippines; Hon. Newton D. Baker, former Secretary of War; Gould Dietz, Omaha, Neb.; Judge William P. MacCracken, Chicago, and William F. Roberts, general manager of the Maryland plant of the Bethlehem Steel Co.

National headquarters has been established at 26 Jackson Place, Washington, with a selected staff of coworkers, and is in control of policies, information and finances. Each of the nine districts will have its own headquarters with a district manager and staff in direct contact with the general public through association chapters, flying clubs, air boards and civic associations. The basic strength of the association will be in its chapter units, chartered by the national body. The chapter is designed to organize the community interest in aeronautics so as to concentrate locally on the association's pledge to foster, encourage and advance the nation's commercial aerial welfare and maintain its independence in this new science.

The platform upon which the association stands is constructive and cooperative and pledged to the encouragement of the up-building of the aeronautic industry as an important factor in the country's economic life; to enlighten the public on the needs and operation of aircraft in business; to use its influence for the creation of a Federal agency that will control and regulate civilian air traffic; to establish airways and landing fields, and uniformity of routes, rules and customs affecting air navigation; to arrange for and assist in exhibits, contests and aerial expositions, and to cooperate with all branches of the Government in furthering the use of aircraft for the convenience and benefit of the people in peace and for national defence in time of emergency.

The membership campaign will stress the slogan of the association, "America First in the Air." The plans for the enrollment have met with the heartiest approval of the founders of the association, who are enthusiastic in predicting a success such as has never before been recorded in a peace-time patriotic movement.

Wright Aeronautical All Metal Pursuit Plane

Points of Particular Interest In The Wright All-Metal Pursuit Plane

THE Wright Aeronautical Corporation of Paterson, New Jersey, has just built, in collaboration with the Dornier Company of Rorsbach, Switzerland, a new all metal pursuit plane.

The construction in this plane is very simple, plain and rugged. All wing beams and highly stressed parts are of steel, while the covering and much of the framework is duraluminum. The framework of the fuselage is built up of a single cover of duraluminum over a series of box type girders which hold the body to its designed shape. When the pilot's seat is removed it is possible for a man to get inside and back almost to the tail. If wires need inspection or if repairs are necessary to almost any part of the shell, this is a decided advantage. Not alone is it possible to work on the inside but there is enough strength in all parts that the workman may suit his own needs as to where he will sit or move. The method of attaching the fuselage to the wing is a departure from standard practice; four bolts hold the four short struts (integral with the wing), and the fuselage together. This is done primarily for pilot's vision dead ahead. The wing is placed so that the pilot's eye comes on a center line, thus making possible vision above and below with a minimum blind angle. The four struts are not cross-braced by wires as in standard practice, there are no brace wires anywhere on the plane, each part being strong enough to stand without external bracing.

The motor bed is the only wood used on the whole plane, a mounting is constructed of box beams of duraluminum and steel where necessary. The whole is neatly cowled in with the top and sides hinged. Snap fasteners catch and hold the parts in a rigid form when in place, but the whole motor can be laid bare as easily and quickly as raising an automobile cowl.

The top part is hinged so that it rests against the wing when raised; the sides bend down and bare the motor to its mounting. It can be replaced almost as

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quickly as opened, and makes a neat streamline form, the lines of which conform to the fuselage.

A fuel tank, capacity of approximately two hours full speed, is conveniently located. To feed to the carburetor, air pressure is used as the tank is not high enough for gravity feed. The oil tank is on the right side and is filled by removing a small hand-hole plate. Both tanks are separated from the pilot's cockpit by a bulkhead for fire protection.

The cockpit is large, roomy, and comfortable. All controls are conveniently placed and every instrument is readily visible. A small windshield protects the pilot from the direct blast of air.

Tail surfaces are bolted rigidly to the main structure. Flipper and control wires are double to insure safety. All controls are sufficiently large and have the proper movement to give a quick and easy control. The tail skid is removable for rewrapping or such other repairs as may be necessary. It is also entirely of metal.

The landing gear is of cantilever design, which does away with the necessity of an axle. Two legs are joined inside the fuselage, in such manner that the shock absorber cord is wrapped around at the top of a forked portion, a pivoting point is just beneath. There is sufficient spring for landing on any ordinary bump, such as all fields have. The benefits derived from this type landing are that very small portion is exposed to air resistance and it is very light. The wheels are reinforced discs with tires 31" x 4", a bronze bearing which has ample surface fits over the hollow forging of the shaft and is held on by a cap. A wheel can be changed about as quickly as a wire wheel on an automobile. No attempt was made to streamline the wheels other than the disc portion, but the leg which extends from the body and holds the wheel is a very fine streamline.

The Lamblin radiator is eliptical in form and is mounted outside the fuselage between the legs of the landing gear. It is believed that this location is the best, because none of the piping is outside and the fin portion alone is exposed to the air. A small expansion tank is of course necessary, in the line and one is mounted up near the motor through which the radiator is also filled. Another good result obtained from this location is that the pilot's vision is unobstructed by a radiator, and in case of a puncture by bullet fire would not be scalded by the hot water. A wing radiator could be used, and then mo.e speed and climb could be expected, as on all occasions where this change was made speed increased from 10 to 12 m. p. h. more than previously.

The flexibility of this kind of construction and its main advantages are not generally realized. For instance, the Lamblin radiator might be removed without leaving a trace of installation; it could be placed elsewhere, or a wing type used. The wing covering could be removed if that were desired, without any harm to the remainder of the wing—a thing which would never make a clean job on a fabric covered wing. In case of a bad dent or holes torn in the body or wing, or by enemy fire, damage of any sort which might occur can be repaired by cutting the rivets, taking out the part ruined and a new piece fit in its place. In this same way a fuselage could be lengthened or shortened, the cockpit opening changed, or an additional one made. To reach vital and necessary parts of the fuselage hand holes are now in use. These are easily attached or removed by pressing a small spring catch. For another installation where the present doors might not fit, new one might be cut after closing up those not needed. If a square patch were riveted over the opening it would scarcely be noticed, as rivets are common to this construction.

The assembly and upkeep of this plane is quite simple because of the lack of wires, etc. A small hoist can raise the fuselage high enough to install the two forks of the landing gear. With this done and shock absorber cord in place the wheels can be slipped on. The tail skid and tail planes can go on next, with the wires connecting them to the controls. The same hoist can raise the wing up and the fuselage run under it and the four bolts tightened, as there are no wires or braces on which to make adjustments. There is little to require attention on the plane when once it is set up and has a motor installed. The service amounts to gasoline, water and oil and little else.

The metal feature in the construction of this plane is of great importance for many reasons other than upkeep and repair. It cannot be brought down by enemy gun fire nor set afire as easily as other planes. It is particularly good that in an accident which wrecks the plane there are no splinters, the metal will buckle and bend but it will not break nor catch fire. If the plane had to be landed in rough country, and it nosed over on landing it is almost sure the pilot would not be hurt. The wing is high enough above the fuselage that when upside down it would keep the fuselage from striking the ground. There is a longitudinal stiffener along the outside of the fuselage but it would not bend so as to fold at the pilot's seat for the reason that the rudder and vertical fin would strike first, thus putting tension in the top of the fuselage. There is every reason to believe that this is a very safe plane to fly. It is impossible to guess what war time developments might demand; if it became necessary to armor a part of this plane this construction lends itself to armoring very readily, which would make the plane even more immune to the dangers already referred to. This is really the first all metal plane in this country with a performance sufficient to make it a pursuit plane.

The visibility on this plane is the best that has ever yet been worked out for a pursuit machine. To look up, or to the side the pilot need but turn his head, when looking directly ahead the two vertical struts which hold the after part of the wing to the fuselage are the only obstruction. The only blind spot which can be found is up directly ahead, the wing there shuts off a very small area. This is not very important for the reason that the pilot may look over or under the wing without difficulty, besides the ship may be quickly and easily climbed, or if climbing straightened out which will take care of the one small obstruction. To the sides there are no blind angles, which has many advantages in pursuit work and also affords the vision necessary for landing in small or crowded fields. There is little occasion for an enemy ever to become hidden by the wing, the absence of a lower wing is of course what many designers have worked toward. Good angles are of the greatest importance in a pursuit plane. To go out, and not be able to see well will lose a fight—even though the plane and motor are O. K., unless the pilot can see well all the time he will be downed by one who can see. This is

Wright Aeronautical All Metal Pursuit Plane

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of greatest importance and presents one of the great advantages of this plane.

This plane is strong enough to stunt. With it any known maneuver can be executed without unpleasant sensation to the pilot. It follows its flight path through and is for that reason a very desirable plane to fly. All the experience gained from the war and research since are incorporated in this plane and it is to be expected that it should go where the pilot points it. All who have seen it fly, and whose opinion is based on lots of experience, agree that it is very exceptional on performance. This is of course due to the fact that the plane is light, and the H. P. sufficient. The plane can be spiralled upward, banked almost vertical, which is a severe test. This is only another form of the "climbing turn", so often spoken of, and used as the greatest necessity for a fighter. No other plane in the world today will climb higher on a turn than this one, nor will it execute a shorter turn.

On the ground and in the hangar the plane is easily handled. It can be taxied cross wind—has been done in 25 m. p. h. with 6 inches of snow on the ground. The take off is very rapid, in fact it can be taken into the air before the motor has been given full throttle. It can be steered and turned well enough so that it is always brought into the hangar under its own power.

DIMENSIONS

Wing Spread—33 feet
Cord—6 feet, 6 inches
Length over all—28 feet
Wing area—200 square feet
Powered with Wright H-3 400 horse-power engine
Air speed—160 miles per hour
Climb—10,000 feet in five minutes
Armament—2 machine guns in front of pilot
Carries two hours fuel supply

Weight empty		1819#
Pilot	180	
Fuel	440	
Ordnance	180.4	
Miscellaneous Equip.	54.7	855.1
		2674.1#

It may be noted from the above figures that the useful load is well over the specified amount required and the performance given is with the over-load.

STATEMENT OF WEIGHTS
D. W. P.

Plane light	1819	pounds
Pilot	180	
Fuel	440	
Ordnance	180.4	
Miscellaneous Equipment	54.7	
	2674.1	pounds

Ordnance carried in ballast to replace weight of following:

1 aircraft mach. gun 30 cal....	245 lbs.
1 " " " 50 "....	52. "
600 rds. ammunition 30 cal......	39.lbs.
200 " " 50 "......	50. "
2 synchronizers	11. "
1 5" ring sight	0.8 "
1 Aldis sight	3. "
	179.13 "

MISCELLANEOUS EQUIPMENT
(Part installed—part in ballast).

INSTALLED:	*lbs.*
Air speed indicator and tubing....	3.0
Altimeter	0.9
Compass	2.7
Clock	0.6
Gas pressure gauge (air)........	0.4
Oil pressure gauge	0.4
Tachometer	1.1
Tachometer shaft	1.4
Water temperature meter..........	1.3
Oil temperature meter	1.3
Instrument board	1.0
Cushion and seat	6.0
Wind shield	0.6
3 way valve	0.3
Switch and wiring	1.0
Inclinometer	0.2
Safety Belt	2.0
Fire Extinguisher	6.5
	30.7
CARRIED IN BALLAST:	
1 oxygen apparatus	14.
	44.7

Consolidation of Government Air Laboratories

OCCASIONALLY one hears a whisper of inquiry on the possible advantages of a centralization of the experimental and testing plants of the Army, Navy and Mail air services.

A concise survey of the various experimental and research activities of the Government in aeronautics has just been made by the Aeronautical Board of the Army and Navy and forwarded to the Joint Army and Navy Board, our supreme "General Staff." The survey also presents some arguments and weighs the advantages of a competitive system.

These separate organizations are as follows. (1) The National Advisory Committee for Aeronautics. The Committee is concerned primarily with fundamental research for all branches of the Government, receives funds direct from Congress and reports to the President. Its services are available to the public as well as to the Government. In addition to Congressional appropriations, the Army has allotted $12,000 and the Navy $36,000 to the N. A. C. A. the current fiscal year to cover work in which these services are especially interested.

Fundamental research, tests and experiments in chemistry, physics and engineering are carried on by the (2) Bureau of Standards, a national institution for scientific research. Its investigations are for every branch of the Government, federal, state and municipal and for the public. Aeronautical work is only a part, covering instruments, engines, luminous paints castings and other structural materials, fabrics, dope, porcelains for spark plugs, glues and so on. The Army and Navy make allotments of their funds to cover special work at the Bureau.

(3) The Forest Products Laboratory, at Madison, Wis., handles problems respecting the properties and treatment of woods, on funds allotted by the Army and Navy, where work is done for these services.

These institutions, the Bureau of Standards and Forest Products Laboratory are concerned mainly with problems other than aeronautics and to concentrate their aeronautical work with the balance in one central laboratory, would be to duplicate in the air services' laboratory and plant certain of the personnel already in the two institutions foregoing. The ceramics division of the Bureau has experts in this subject. Their study of spark plug insulators for the air services is only a part of the routine. Likewise, the major portion of the Forest Products plant is for other uses than those of the air services.

We come then to the (4) McCook Field plant of the Army Air Service and the (5) Naval Aircraft Factory at Philadelphia. Surely something's wrong here.

The Army has its design, testing and experimental organization, with procurement facilities, at Dayton. It is admitted that it would be preferable to have the plant nearer civilization but it has been argued that the cost of removal over such a long distance would be rather too great to be borne. Besides, Dayton's citizens have raised a fund to present a nearby location and the pay roll of McCook Field is not to be sneezed at, at least, it is so claimed by one of that city's house organs. However, that's another story.

The Navy does its design work in Washington, has its Naval Aircraft Factory at Philadelphia for the execution of experimental work and the air station across the river from the Capitol for flight tests.

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There are some advantages here. Design, construction and flight are in competition. Competition is the life of trade and, next to necessity, the mother of invention, or at least its mother-in-law. The same organization that designs does not do the testing, as is the case at McCook.

There is admitted duplication by the Army and Navy in engine testing, between Washington Navy Yard and McCook Field, and in other work. It is believed by the Aeronautical Board that competition in the experimenting and testing is an aid to progress in aeronautics, just as in the automobile industry. Civilian manufacturers are working with the Navy in one place and with the Army at another place, on engines, floats, planes, and so on, where the constant interchange of thought creates mental friction, heat, work.

Liaison in all these experiments and tests, between the Army and Navy, is an established fact. Each is in touch with the other and knows what is going on. This duplication is with the assent of the Aeronautical Board.

However, while certain duplication of effort is permitted and advised the Aeronautical Board, under the policy of the Joint Army and Navy Board, published in General Orders of the War Department has operated to prevent duplication along other lines.

Development of new types of aircraft or of weapons to be used from aircraft are carried on where possible by but one air service and questions relating to the development of new types of aircraft or weapons are referred to the Aeronautical Board for recommendation as to which air service will be charged with the work.

The development of rigid airships has been carried on by the Navy thus far but the Army is now suggesting that it be permitted to undertake independently the further development which will be required for functions peculiar to the Army.

In conclusion, it is not considered by the Aeronautical Board advisable to consolidate the activities of the Army and Navy at McCook, Philadelphia, Washington and Anacostia into one big union.

There are, of course, other Government agencies working in aeronautics, but not in the development of aircraft or their accessories, save in the case of the Bureau of Mines which has to do with certain work in helium and hydrogen. This activity of the Department of the Interior has built a railroad re-purification plant for hydrogen, experimented with the storage of hydrogen and helium in underground storehouses and mines, in the extraction of helium and has employed aircraft in mapping. It furnishes assistance in the investigation of fuel and pyrotechnics.

The Department of Agriculture uses airplanes in forest patrol, campaigns against boll weevil, crop estimates and the like.

Aircraft is used by the Air Mail, of course, and by the Coast Guard. The various mapping agencies of the country are interested in aerial mosaics and are using or have used aircraft, or are likely to—Bureau of Public Roads, Bureau of Soils, Forest Service, Coast and Geodetic Survey, Geological Survey, General Land Office, Indian Affairs, Reclamation Service, Hydrographic Office, Topography Branch of the Post Office, Air Service of the Army, Corps of Engineers (in civil and military activities), General Staff, Lake Survey, Mississippi River Commission, International Boundary Commission; all these have mapping activities. The Bureau of Fisheries is interested in aircraft and it is likely still other branches of the Government will be investigating possibilities.

Fokker F 5 Commercial Transport

THE latest and most advanced airplane developed in Europe for use in the air lines is the new Fokker known as type F 5. The most versatile of airplane designers has here incorporated all the experience gained during the last three years with his F 2, F 3, and F 4 types; of these the latter two are especially well known, the former for its consistent record for safety and economy on five of the main European air lines, while the F 4 type, in the hands of the United States Army Air Service made two of the greatest flights in the history of Aviation in October and November, 1922, the world's endurance record 35 hours 18 minutes and the longest non-stop cross country flight ever made, from San Diego to Indianapolis, a distance of 2060 miles. On the strength of these past performances alone a new type of Fokker commercial plane is sure to be of extraordinary interest, but it will be seen from the following description that it is an interesting development on the strength of its novel features also.


Interior F-5 Commercial Transport

In the first place it should be explained that in the course of commercial operation during the past few years the divergent requirements of each route have become more and more clear. A route like that between Koenigsberg and Moscow, a distance of approximately 750 miles over which a regular service of three round trips weekly is maintained with Fokker F 3 monoplanes and where the railroad service is almost non-existent, the obvious need is for a plane of large carrying capacity, while high speed is not of such great importance. Incidentally, this route is the longest in the world regularly flown without change of airplane or pilot.

On some of the other lines, where there is direct competition with the fast railroad service or the loads carried are largely urgent express matter and mail, high speed, even at the sacrifice of considerable load capacity and at the cost of

increased landing speed, is essential.

In the Fokker F 5, one of the chief features is the possibility of quickly varying these characteristics. It is clear that this procedure will also go far towards making it possible to build commercial planes in the small quantities at present required at a more reasonable price than would be the case if a separate type of plane has to be designed to suit the requirements of service on each line.

It has been the aim of the designer to produce a fuselage which would suit every requirement and on which wing systems of various designs can be fitted while maintaining the good flying qualities for which Fokker planes are noted, whichever type of wings is used. For this the internally braced, or cantilever type of wing construction of which Fokker has for years been one of the most successful exponents, is of course particularly suitable.

The F 5 may be flown as a biplane or a monoplane, by the simple expedient of attaching or removing the lower wings. As there is no bracing or rigging this is a simple matter. The top wing is in one piece and 49 ft. in span. Its factor of safety is so high that it will carry the weight of the machine, although with reduced load, as a monoplane or it will carry the load from two bottom wings hingedly attached to the fuselage and supported at the outer ends by N struts.

As a monoplane, the total useful load is 2000 lbs. which is equivalent to two pilots, 5½ hours gasoline at cruising speed and 770 lbs. of pay load, and the maximum speed approximately 118 miles per hour.

Interior of Fokker F-5

As a biplane, the useful load is increased to 3200 lbs., equivalent to the same amount of fuel, two pilots and 1950 lbs. pay load, and the speed is 110 miles per hour.

The above performances apply to the F 5 as fitted with a Liberty engine. The experimental machine has been flying with a Rolls Royce engine of only 340 HP, but practically any engine of approximately 350-450 HP can be fitted.

As in the previous Fokker commercial planes, the wings are built up with a very high factor of safety on box spars and covered with 3 ply veneer. In connection with this method of covering it is interesting to note that the wings of some of the F 3 machines which have been in constant use for nearly three years, were recently opened up for inspection and found to be as good as the day they were built.

A very simple nose radiator cooling system is used, which can be removed from the machine separately or in one unit with the engine by taking out 4 bolts; the radiator is circular in front view, which has made it possible to design a fuselage of very efficient shape in spite of the large cross section necessitated by the cabin.

Two pilots with full dual controls are seated behind the engine, side by side, in a very roomy cockpit, with a door between the seats through which either pilot can go down into the cabin. The engine controls and all instruments are fitted in the center of the cockpit so that they are equally accessible to both pilots. Wheel control is used for the ailerons and all controls are non magnetic.

The gasoline system consists of a double gravity tank in the wing and one feed pipe only. The shut off cocks are fitted directly to the tanks, and within reach of either pilot.

The control cables all pass outside of the fuselage where they are constantly

(*Continued on page 232*)

Side view Fokker F-5 Commercial Transport

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Recent Developments in Aircraft Engines in the Navy

By Bruce G. Leighton, Lieutenant, U. S. N.

High Overhead in Naval and Military Aeronautics due to Necessity for Frequent and Costly Repairs and Replacements—High Costs Stand in Way of Commercial Industry—Navy Jumps Standard Test from 50 to 300 Hours—Engines in Flight Taxed only Half the Burden of Ground Tests—Liberty Requires 4.2 Man-hours of Overhaul for Every Flying Hour—New Navy 775 h. p. Engine to Weigh but 1.55 Lbs. H. P.—Future Engines of Larger Bore and Stroke—Anti-knock Fuel Development—Failures of the Liberty—Air-cooled Engines Have Advantages—Air-cooled Engine for Commercial Work Increase Pay Load—Radical Departures Expected in Engines Soon—Editor.

THE Army and the Navy are today the principal users of aircraft in this country and for this reason, pending the extension of aircraft into the field of general commercial transportation, it falls naturally to the lot of these two organizations to become the principal sources of information relative to material developments and operating experience in aircraft.

Development in aircraft construction and operation is limited by two considerations, first the amount of funds appropriated to the Services by the Federal Government, and second the effectiveness with which the funds appropriated are expended.

In the following paper I shall attempt to outline the development work that has been done in the particular field of power plant development, with the funds which have been appropriated specifically to the Navy. The scope of the work has been so broad and the details so manifold and varied that time does not permit more than a broad outline of the more important work which has been completed or is in hand. I shall confine myself to the engine itself, and dismiss the subject of accessories, fuel systems, cooling systems, and the like—important as they are—with the bare statement that development in these particulars has kept pace with the engines.

In classing this development work as work done "in the Navy" or "by the Navy", I refer to work done under Navy supervision and control, and paid for principally from Naval appropriations. A very great portion indeed of the details of development has been actually executed in private engineering organizations with funds which the Navy has allocated from its appropriations for the particular purpose in view. It has been the Navy's policy at all times to handle development projects wherever practicable through the medium of contracts with private engineering organizations, under conditions which assure a reasonable profit to the contractor, to the end that these private engineering organizations may be kept alive and in a healthy condition as the nucleus for the strong well organized commercial aircraft industry which is so vital to the national defense. Without the splendid ingenuity, genius, and resource which have been displayed by the various organizations which have been employed in this work, the results which have been obtained could not have been possible.

It is impracticable to name the various organizations which have been employed in this work, for obvious reasons. Suffice it to say that the Navy has called freely and fully for advice and counsel upon the magnificently organized engineering societies of the country, and upon the various government bureaus and agencies engaged in pertinent lines of work, and has at all times availed itself of the invaluable experience and resource of various private engineering and manufacturing concerns engaged in all manner of engineering work. It has everywhere met with most cordial coöperation and hearty assistance, for which acknowledgment is gratefully made.

Fundamentally, success in aircraft operation—whether it be commercial or military—is largely—one might say almost entirely—dependent upon two vital factors: first dependability and safety, and second low operating cost per ton mile if pay load carried. Safety and dependability may be had, of course, without low operating cost, but certainly low operating cost cannot be had without safety and dependability. Probably the greatest contributing factor to the present high cost of aircraft operations is the enormous overhead expense incurred by the necessity for frequent and costly repairs and replacements, and by the necessity for constant and most meticulous attention to details. The question of operating cost is perhaps of slightly less moment in military operations than in commercial operations, but just as high operating costs are today standing in the way of the establishment of the thriving commercial aircraft industry which is so vital to our national defense, so are high operating costs most seriously retarding the full realization to our Army and Navy of the tremendous inherent possibilities in aircraft as a weapon for offense and defense.

That our national defense sorely needs a strong self-supporting commercial aircraft industry, goes without saying. The question is, how to create such an industry. And the obvious answer is, let it

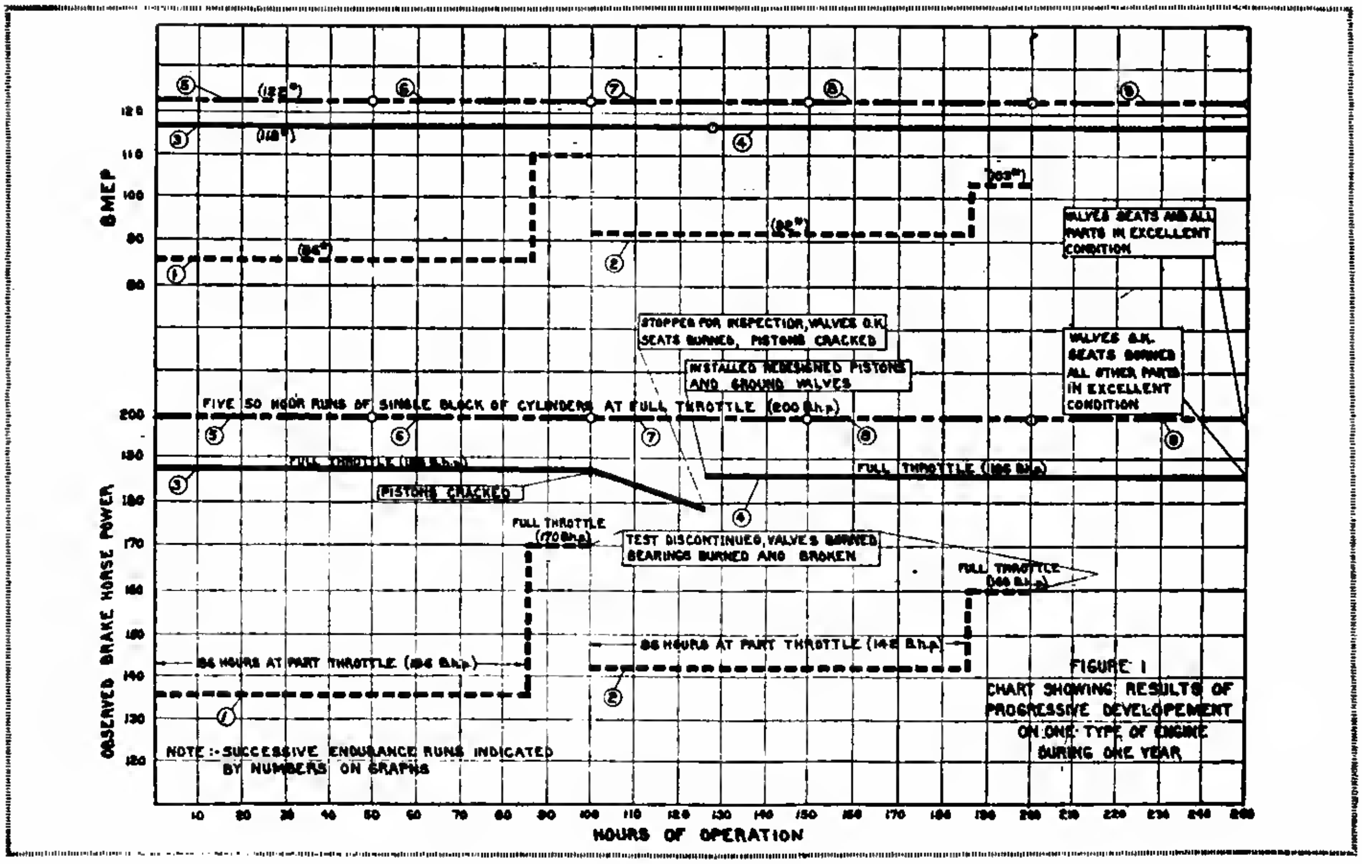

FIGURE 1
CHART SHOWING RESULTS OF PROGRESSIVE DEVELOPMENT ON ONE TYPE OF ENGINE DURING ONE YEAR

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once be fully demonstrated that aircraft are safe, that they are thoroughly dependable, and that the cost per mile per ton of pay load carried is comparable to that of other commercial carriers; let these things be clearly demonstrated and there will be no need of worrying about the creation of a commercial aircraft industry:—it will create itself.

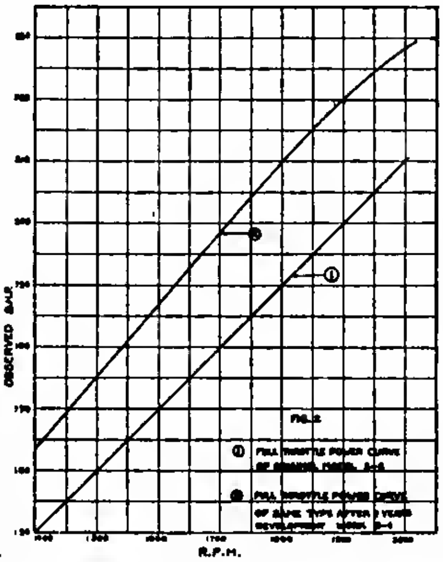
These factors are properly the first concern of the naval and military aircraft services of our country, and it is largely in this light that we should view the development work that has been done and is still to be done. Dependability and reasonable durability must come first and always. With thorough dependability comes safety, and a material reduction in maintenance costs. Next in importance to dependability and durability comes reduction in aircraft weights, because every pound that can be saved in the structure of the aircraft results in a corresponding increase in pay load, or in speed, and a decrease in the carrying cost.

Generally speaking, an aircraft is only so good as the power plant which sustains and propels it. Advance in the performance of the aircraft as a whole can proceed little faster than advance in the performance of the power plant. The two are inseparable.

Excellence in performance is purely a comparative factor, and can be visualized only by reference to some fairly definitely fixed standard of measurement. The standard against which we have in the past measured the excellence of aircraft engines has been the so-called standard fifty-hour test which, stated briefly, requires little more than that an engine shall complete ten five-hour runs at between 90 and 100% of its rated output without failure in any "major" part, and without "persistent"—mark the word—"persistent" failure in minor parts.

Practically all types of engines in common use today have satisfactorily met the requirements of our fifty-hour test standard, and yet it is a fact that failures of engines and engine accessories have been responsible for more uncompleted flights, forced landings, and accidents than all other causes combined. The requirements of the accepted test specifications have been met, but apparently the requirements of actual flight service have *not* been met. It follows, then, that the 50-hour test as a standard of acceptance must be inadequate. Safety, dependability, economy, all demand something far better.

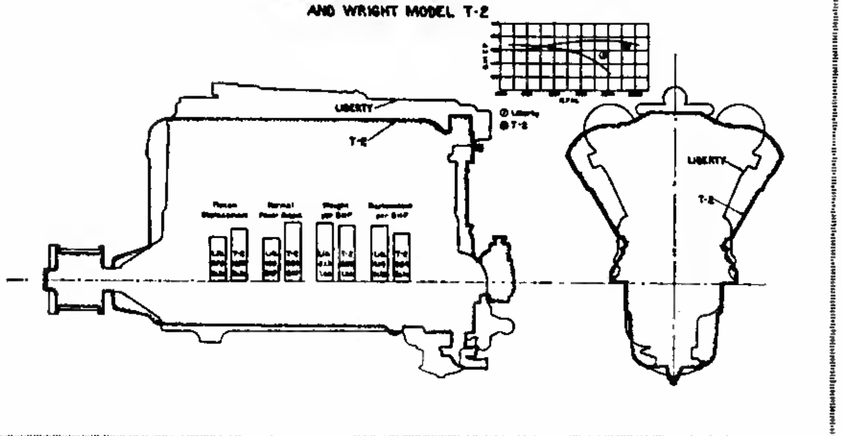
Something over a year ago, the Bureau



of Aeronautics, of the Navy Department, set up tentatively as a mark to shoot at, a new standard of service acceptability, a test which aimed at demonstrating the entire capability of engines to give continuing dependable service without necessity for overhaul or other than minor repairs or adjustments for at least as long a period as one might reasonably expect the structure of an airplane to stand up without a thorougb going over in normal flight service. The test as originally outlined required three one hundred hour periods of continuous running. Each one hundred hour period comprised 86 hours at an output corresponding to normal cruising power at 2,500 feet altitude, and 14 hours at wide-open throttle at sea level, to simulate conditions which obtain in take-off and initial climb. This was a long step ahead of the old standard fifty-hour test requirement, and it must be confessed that when we first set up the new standard we were actuated a great deal more by a determined hope than by confident expectancy.

A year's intensive work on a number of types of engines has fully convinced us, however, that this measure of excellence is quite capable of being fully realized in all classes of engines, without in any way increasing the weight, and we have recently raised the standard to 300 hours of continuous wide-open throttle running at sea level.

FIG.-3
COMPARISON OF STANDARD LIBERTY AND WRIGHT MODEL T-2



It should be fully realized that wide-open throttle running at sea level taxes an engine far more than does the kind of running which it gets in the hands of an experienced pilot in normal flight service. Actual comparison made between conditions noted in identical engines after full throttle, sea level running, and after normal flight operation, indicate clearly that the life of an engine in normal flying service is at least double the life of the same engine under full throttle, sea level running. On this basis, which our experience indicates to be entirely safe, a 300-hour wide-open throttle test at sea level is the equivalent of at least 600 hours of operation in normal flying service. At an average cruising speed of 75 miles per hour, this represents some 45,000 miles of cruising. Few airplanes have yet been built whose structures will stand up for this amount of cruising without very complete and extensive overhaul, if at all. I mention these things to indicate that the goal we are aiming at is far above the present general measure of acceptability.

As an example of the type of work that has been done, I shall cite several specific instances.

An engine of the model which is being installed in our first rigid airship—the Packard 1A—1551—has already completed 300 hours of practically continuous running developing the maximum output which it will be called upon to develop in flight service. No repairs or refitting of parts were made throughout the entire test and at the end of test careful inspection proved the engine to be still in excellent running condition and in need of no repairs or adjustments. As an indication of the excellent valve conditions which obtained, the average fuel consumption of this engine for the whole 300 hours of running was slightly less than .44 lbs. per B. H. P. per hour. In fairness to other models of aircraft engines, it should be pointed out that this engine was especially designed for airship service and is very much heavier than engines used in other classes of service.

In the lighter types of engines, more particularly adaptable to H/A service, we have completed a 300-hour test in three one hundred hour periods with one type—the Aeromarine U-8-D—an eight-cylinder Vee water-cooled engine. During this test the engine was run at part throttle at 1800 r.p.m. developing an output equal to normal cruising power at 2,500 feet altitude for a total of 258 hours, and at wide-open throttle at sea level for 42 hours. At the end of the 292nd hour of the test, a break occurred in the crankshaft which required the installation of a new shaft to complete the run. This break was serious, of course, but of such a nature that the cause was quite evident and the remedy comparatively simple. Aside from this failure, and slight retouching of part of the intake valves at the end of the first 100 hours, no adjustments or repairs were made to the engine throughout the test. At the end of the test the power output of the engine was slightly greater than at the beginning, the valves and seats, the bearings, gears, —in fact, all parts—were in excellent condition and in need of no repairs or refitting. This was an extremely gratifying performance from the standpoint of durability and a distinct encouragement, but the engine as tested compared unfavorably in weight per horsepower and in installation dimensions with another engine of approximately the same power which had been in wide service use.

For specific example of the importance of weight reductions see Appendix 1.

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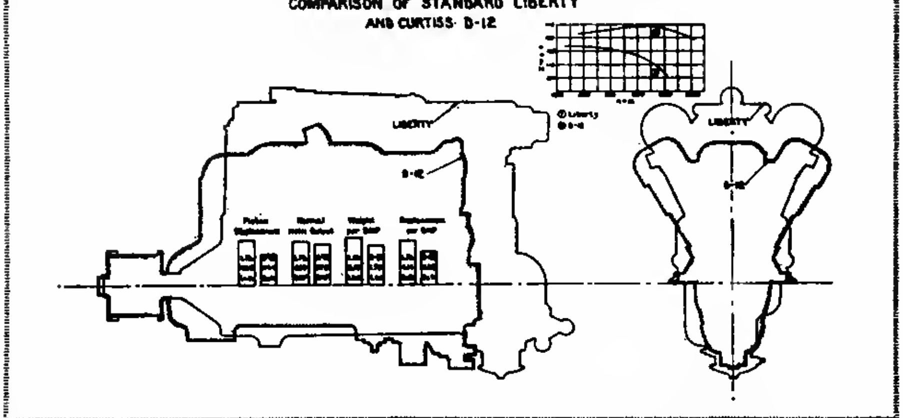
We accordingly set about having changes made in the design not only materially to decrease its weight, but at the same time materially to increase its output, keeping still the same excellent durability characteristics. The redesign (designated the U-873) was completed and subjected to preliminary tests at the increased output. Certain difficulties were met with which entailed slight further redesign in certain parts to maintain the all around durability characteristics desired. The engine is now finally completed, has satisfactorily undergone its preliminary trials, and is about to be subjected to its final endurance test, comprising 300 hours of continuous full power running. All indications are that this test will be satisfactorily completed.

The original model of this engine, the U-8-D, weighed 575 lbs. and developed 225 B.H.P. at 1800 r.p.m. The modified engine now under test—the U-873—weighs 520 lbs. and develops B. H. P. at 1800 r.p.m.

Another, and materially lighter model, the Wright Model E-2, having approximately the same general characteristics as the U-8-D was submitted to the same test. This model, a development of the small Hispano-Suiza, has been used extensively in our service for advanced training airplanes with very good results by comparison with other engines previously in general use. Our records show that its flying life between overhauls averages 101 hours, as against 72 hours for the Liberty engine. It had repeatedly been subjected to standard fifty-hour tests, and was thought to be an exceptionally durable type, but when we got into long duration testing unexpected shortcomings were uncovered, principally in the connecting rod bearings, valves, and valve seats, all of which went bad before the first hundred hours had been completed. The subsequent development work on this engine is particularly interesting because the results obtained have so completely justified our adoption of the 300-hour test standard in place of the old 50-hour standard.

Figures 1 and 2 show the progress that has been made. Referring to Figure 1, graph (1), is a graph of the first attempt at a 300-hour run. Note that in the 14 hours full throttle running at the end of the period the power output was considerably below the normal rated power of this model, 180 B.H.P. at 1800 r.p.m. This condition was brought about by the poor valve conditions. After this run new connecting rod bearings and valves of the original design were fitted, valve seats reamed out and valves readjusted, and a second attempt was made as a check on the first, with the result shown in graph (2). After some investigation and experimentation, new valves and bearings were developed, and were fitted in a new engine of the same model. This engine was then set up and subjected to a practically non-stop run of 125 hours at wide-open throttle as shown in graph (3). Examination at the end of this test showed no evidence of bearing failure, that the valve burning had been corrected completely, but that the valve seats were seriously eroded. The valves were reseated and adjusted, new pistons of modified design installed. No other parts were repaired, replaced, or refitted. This same engine was then submitted to a second continuous run of 125 hours at wide-open throttle as shown in graph (4). At the end of this run the modified pistons were in excellent condition. Valve seats were again found to be badly eroded, but valves were still in excellent condition. Careful inspection disclosed no evidences of deterioration or serious wear in other parts. Further testing of this engine was discontinued and the engine was laid aside until means could be found to overcome the valve seat difficulties. An entirely new design of cylinder block was laid out and one block built for test. At the same time changes were made in cam contour to better the volumetric efficiency and increase the output. A single block of this new design has recently been subjected to five consecutive fifty-hour non-stop runs at full throttle. Graphs (5) to (9) inclusive indicate the results of these runs. In preparing these latter graphs the output of the single block has been doubled to represent the output which is to be expected from the complete engine. During this 250 hours of wide-open running, there has been no evidence of valve trouble, the valves have not been ground nor adjustment made, and both the valves and seats appear to be in practically as good condition as when originally installed. Two of these new cylinder blocks, with the modified cams, have been substituted for the old style blocks on the same engine that completed the previous 250-hour test and this engine is now being set up for further endurance running at wide-open throttle. Aside from the new cylinder blocks and cams, this engine is in exactly the same condition as at the end of the previous 250-hour test, no adjustments, repairs, or replacements in other parts have been made. All of the changes mentioned above are being incorporated in new engines under construction, which are known as Model E-4. In Figure 2 is shown a power curve of the original E-2 and of the modified engine as determined by actual test of assembled engines.

FIG-4
COMPARISON OF STANDARD LIBERTY AND CURTISS D-12

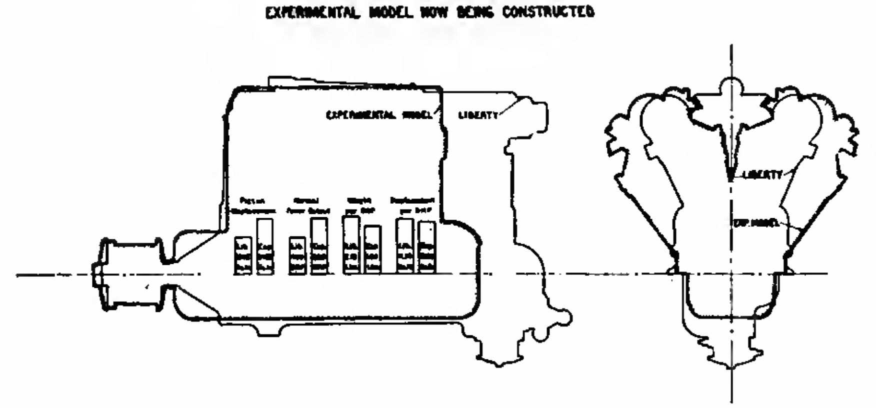


While a full three hundred hour test at continuous wide-open throttle has not yet been completed with this engine, the running which *has* been done justifies the prediction that this engine as modified is quite capable of withstanding such a test.

Work of a similar nature to that outlined above has been in progress in all classes of engines for all types of service, and with very similar results. Invariably, the efforts that have been made have resulted in a marked increase in durability, and practically without exception changes in design have at the same time resulted either in a decrease in weight, an increase in output, or both. Much remains to be done, of course, but lessons learned from development work in one type are usually more or less applicable to all types, and from the tests which have been completed thus far, and from those which are now in course, we have become fully convinced that it is a question of only a short time until we shall have a complete line of engines for all types of service operations ranging from 60 to 700 H.P., some air-cooled, others water-cooled, which will be capable of withstanding at least 300 hours of continuous full throttle running without failure in any part.

The costs involved in overhauling aircraft engines are not generally appreciated. The records of our service show that the standard Liberty engine, a 50-hour test product, requires complete overhaul every 72 hours of flying operation. Averages show that it requires approximately 300 man hours of direct labor at each overhaul to remove a Liberty engine from a plane,

FIG-5
COMPARISON OF STANDARD LIBERTY AND EXPERIMENTAL MODEL NOW BEING CONSTRUCTED



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disassemble, clean, repair, and refit, reassemble, test, and reinstall in the plane. This does not include supervision, or transportation to and from the shop. In other words, for every hour that the engine flies, 4.2 man hours of direct labor must be paid for, within the walls of the overhaul shop. Skilled labor is required for this work. I believe that $1.50 per man hour is a very conservative figure for the cost of such labor plus overhead, which gives a cost in overhaul labor alone of $6.30 per flying hour of the engine. At a cruising speed of 75 miles per bour, this represents an overhaul labor cost of 8.4 cents per mile for a single Liberty engine plane. It does not include the cost of replacement parts required in connection with overhaul. These oftentimes reach a value up to 25% of the total cost of a new engine. It does not include the cost of the operating and field maintenance crews and equipment. The overhaul cost of operating an engine is inversely proportional to the durability of the engine. As I have previously indicated, the three hundred hour wide-open throttle test which we are now coming to adopt as standard is probably the equivalent of not less than 600 hours of normal flying operation. It requires only a little elementary arithmetic for one to appreciate the importance of this work.

The work which has been done has most forcibly demonstrated two extremely important things, first that we may confidently predict for the immediate future a degree of dependability and durability in aircraft engines, which will at least equal that of the aircraft structure itself, which means that frequent removal of engines from aircraft for overhaul is not necessary and that the quantity of spare engines and replacement parts can be enormously reduced, and second that to realize this degree of dependability it is not necessary that the weight per horsepower developed be at all increased over the weights which are present in ordinary engines of today.

Reduction in Weights

Contrary to a rather widely accepted belief, the features that result in the greater decreases in weight are at the same time features which inherently tend to increase rather than decrease the factors of safety in vital engine parts. To use a familiar example, a 12-cylinder Vee type engine can inherently be made more durable than a twelve-cylinder "in-line" engine of the same weight and power for the reason that the backbone of the engine—the crankcase and crankshaft—are, due to their shorter lengths, enormously stiffer. Long crankshafts and cases are inherently heavy, flexible, and weak; short crankshafts and cases are inherently light, stiff, and rugged. Multiplicity of parts is within reasonable limits an enemy to ruggedness and dependability, and in a large measure at least is incompatible with light weight. Within limits, it requires less weight of metal to enclose a given cylinder volume in a few cylinders of large bore than in a large number of cylinders of small bore. After all, and again within limits, it is the total piston displacement that largely determines the limiting possible output of an engine, not the number of cylinders. The more recent engine designs which have been developed for our service have all been drawn up with these principles in view. Figures 3, 4, and 5 illustrate the results of this trend in design. Figure 3 is an engine recently developed—the

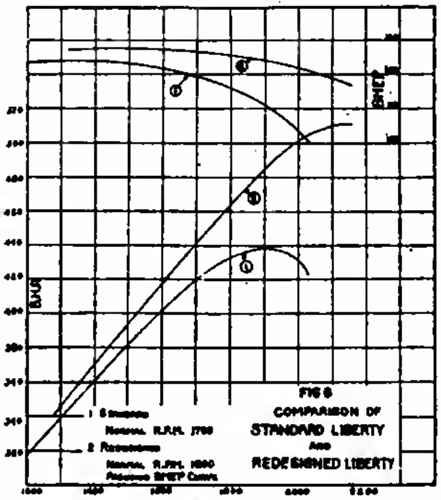


FIG 6

Wright Model T-2*—which has 1950 cubic inches piston displacement, and a normal output of 550 B.H.P. It weighs 1150 lbs. No weight has been spared in the design of the stressed parts. As a matter of fact, its weight per cu. in. of piston displacement is considerably greater than is the Liberty engine for this reason. But it has on test fully demonstrated its ability to stand up to a 550 H. P. output immeasurably better than the standard Liberty stands up to a 400 H. P. output, and the weight per effective H. P. output has consequently not been increased.

Figure 4 is an outline of a smaller 12-cylinder engine—the Curtiss Model D-12*—especially adaptable to pursuit work, which has been perfected, during the past year, and which is now being used rather widely in newer types of aircraft. This engine has a total piston displacement of 1145 cu. in., weighs 670 lbs., and develops 375 B. H. P. at 1800 r.p.m. An engine of this type has recently completed a 100-hour endurance test without failures or serious deterioration in any parts, and is now being subjected to further testing at full throttle. Previous to the 100-hour test, this same engine had completed something over 100 hours of preliminary test running during which certain minor changes in design were incorporated. So far as the highly stressed parts are concerned, however, no evidences of weaknesses have been uncovered in more than 200 hours of test running at or above three quarters power.

Figure 5 is an outline of another experimental type now under construction. This engine is barely out of the design state at present and for this reason I should hesitate to mention it were it not that it illustrates so well the possibilities in reduction of weight per unit of power through economy in crankcase and crankshaft lengths, rather than by reduction of sections in stressed parts. By an ingenious and somewhat unusual cylinder arrangement and construction, it has been possible to obtain a total piston displacement of 2450 cu. in. in the extremely small overall dimensions shown. The weight will be 1150 lbs. It has been designed for an assumed output of 775 H. P. at 1800 r.p.m. but for the purposes of preliminary trials will be rated at 625 H. P. at 1650 r.p.m. Its weight per rated horsepower will be 1.8 lbs. On the designed 775 H. P. basis its weight per H. P. will be 1.55 lbs.

This engine is not yet completed and hence no test data can be given, but by virtue of the extreme compactness of the design and by careful study of stress distribution it has been possible to provide unusually high factors of safety in all the highly stressed parts and still keep the overall weights extremely low. By virtue of these high factors of safety, the dependability and durability should be very excellent indeed.

Other new experimental models which promise comparable weights per horsepower with excellent durability characteristics are now under construction and are expected to be ready for running tests in the near future.

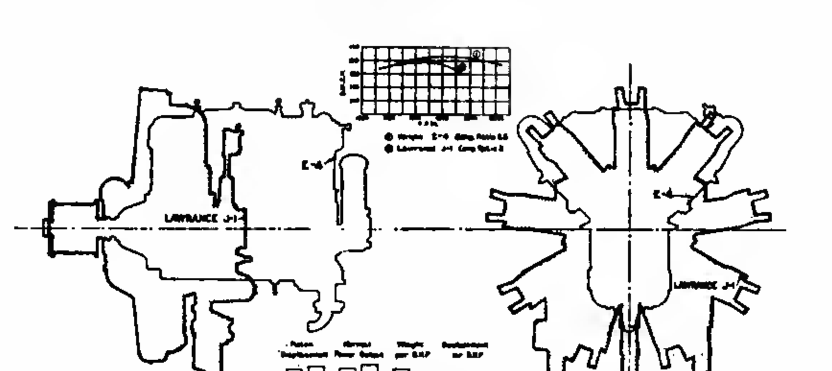
The practicability of using much larger cylinder bores than are commonly used in aircraft engines has been under most careful investigation. A six-cylinder vertical "in line" engine has been built and recently tested, which has cylinders 7" bore and 8" stroke.*

*A complete description of this engine has already been published, see Automotive Industries, Vol. 47, No. 2, July 13, 1922.

*A complete description of this engine has already been published in Aviation, Vol. 13, No. 16, October 16, 1922.

*A complete description of this engine, the Wright Model D-1, has already been published. See Automotive Industries Vol. 46, No. 16, April 20, 1922.

FIG-7
COMPARISON OF WRIGHT E-4
AND LAWRANCE J-1



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This engine was especially designed for dirigible service which requires certain attributes not conducive to extremely light weights, and weight considerations were subordinated somewhat to these considerations. In the preliminary tests of this engine, much valuable information relative to the performance of larger bore cylinders has been gained. Special high performance runs of a test cylinder have been conducted at a compression ratio of 6.5 to 1, developing a B. M. E. P. of well above 140 lbs. per square inch at 1400 r. p. m. No trouble has been experienced in cooling the pistons or cylinders either in the test cylinder or in the complete engine. The tests thus far conducted with the complete engine have demonstrated the entire suitability of the design for dirigible service. Further tests are in course and projected to study the possibilities in the use of cylinders of this or even larger sizes in the construction of larger power units for heavier than aircraft service.

In this connection, with the use of large bore cylinders the question of inertia forces is a very serious problem. To offset this difficulty, the use of duralumin connecting rods and of magnesium pistons has been under serious consideration. Rods and pistons of these materials are being procured for exhaustive block and service tests in Liberty engines with a view to adopting similar practice in all types of engines.

In all more recent designs, the possibilities of increasing rotative speeds and B. M. E. P.'s have been constantly in mind and newer designs have been laid out accordingly. That the factors of safety provided are adequate to withstand over-loading has been well demonstrated in special high power running of more recent designs. The engine shown in Figure 3 has been run for hours continuously at 20% overload without failure in any part. The engine shown in Figure 4 has been repeatedly flown in racing service at an output of 450 B. H. P. at 2300 r. p. m. without evidence of failure.

The question of realizing higher specific power and lower specific fuel consumption through the use of high compression ratios has been thoroughly investigated. We are indebted to the Bureau of Standards for much valuable research in this line, not the least of which has been a study in collaboration with the Bureau of Mines, of the sources of supply for various anti-knock fuels in the country. Much of the work which has been done in this connection by the Bureau of Standards has already been presented in a paper read by Mr. S. W. Sparrow.* As the result of this work coupled with a considerable amount of corroborative block and flight testing which we have done with various service types of engines, we have become thoroughly convinced of the entire practicability of using in general service considerably higher compression ratios than we are now using. The chief problem to be solved is, of course, the procurement of a fuel which will not only eliminate detonation without interfering with proper engine operation in cold weather,* and without attacking the materials of the engines, but which will also he readily available for general distribution in large quantities at a reasonable cost. Anhydrous alcohol appears to fulfill the requirements quite satisfactorily, and we are now, after extensive preliminary investigation, proceeding with final service tests by conducting all flight operations at three of our air stations, with a blend containing 30 parts alcohol and 70 parts gasoline.

The use of higher engine speeds for increasing the output without increase in weights is very attractive but is only of real advantage if light weight and thoroughly dependable reduction gears are available. This is one of the most difficult problems which we have had to face. It is a relatively simple matter to make durable gears, but far from simple to make *light* durable gears which will stand up as long as the rest of the power plant. This problem appears now, after more than four years of continuous study and experiment, to have been pretty well solved. One very important development has been the interposing between the crankshaft and the gears spring couplings which iron out the torsional vibrations and relieve the gear teeth of the immense fatigue stresses imposed with the ordinary rigid connections. We are now proceeding, with confidence, to the construction of dependable and durable gears, which have an overall weight of .25 lb. per H. P. absorbed, or less.

The Liberty engine, owing to the fact that so many engines of this type are already on hand, deserves more than passing attention. It has been apparent for some time past that the Standard Liberty Engine has rapidly been falling behind the procession. It has neither the durability, the dependability, nor the weight factor to compete successfully with more modern types. Its life in normal service, as I have mentioned before, is but 72 hours between overhauls, it requires constant and most meticulous attention at all times. Forced landings due to all manner of minor failures, and occasionally due to major failures, are relatively frequent and not infrequently result in complete loss of aircraft. We can ill afford to predicate our national defense upon aircraft equipped with this engine, when such aircraft must be called upon to meet on equal terms aircraft equipped with more modern types. Yet we can ill afford to discard the large supply of these engines which still remains in store, bought and paid for, and purchase from present appropriations new engines to replace them.

A careful study of the failures which occur in Liberty engines in service indicates that the weakness of the engine lies primarily in its lack of rigidity, in the manifolding, and in the valve actuating mechanism. Probably the most annoying source of trouble lies in the frequent occurrence of water jacket leakages in flight. This trouble cannot, apparently, be corrected short of complete redesign of cylinders. This is at present being done, experimentally. To kill three birds with one stone, the redesign of cylinders has taken the form of a six-cylinder aluminum cylinder block, with complete new cam actuating mechanism and intake manifolding which follow very closely the cylinder, valve, and manifolding design of more modern types. The use of the block construction enormously stiffens the engine and should, in a large measure at least, eliminate the troubles which have resulted from this lack of rigidity. At the same time the jacket failures are eliminated, while new valve mechanism and manifolds result in a materially improved volumetric efficiency. Other minor modifications have already been made, or are being made, in standard engines in service to correct timing gear breakages, generator failures, connecting rod bearing difficulties, piston burning, and the like.

The first experimentally modified engine is practically completed and trials will be begun in the near future. It is too early as yet to predict with assurance its entire suitability for service use, but the fact that the new parts installed incorporate practically identical features to those now in common use with superior results in more recent models, should assure a very marked improvement indeed.

In Figure 7 are given two graphs showing first the present power output of the standard Liberty engine, and second the predicted performance of the modified engine, based upon actual test results obtained with similar cylinder, valve, and manifold construction in other types of engines. Particular attention is drawn to the relatively low B. M. E. P. values realized in the standard Liberty, and especially to the sharp break in the B. M. E. P. curve at about 1650 r. p. m. It is this characteristic as much as the frequent cylinder jacket failures which has led us to complete redesign of the upper works of the engine.

In this modification we have cut deep, it must be admitted, but after most careful study and continuous testing of a number of alternative courses which suggested themselves, we have become convinced that there is no other course. We have been greatly restricted in this work by the fact that modified parts must always be applicable to the standard Liberty crankcase, shaft, connecting rods, pistons, and accessories. There is no doubt that the power output shown in Figure 6 will be realized nor is there any doubt that the engine as modified will be measurably more durable and dependable than the standard Liberty. The only question is, how *much* more dependable and durable it will be. This is a question that can be answered only by actual running tests which are about to be begun.

The Air-Cooled vs. the Water-Cooled Engine

I have been rather hesitant about entering such controversial ground as a discussion of the relative merits of the air-cooled and the water-cooled engine, but the work that we have been doing during the past two years has brought so much definite information to light that the subject cannot well be passed over.

If we assume equal durability, flexibility, and fuel economy, I believe that every one must agree that the air-cooled engine must have a distinct advantage over the water-cooled engine for aircraft service, owing to the elimination of the weight and complications imposed by radiators, water, and piping. The chief contention between the air-cooled and the water-cooled proponents appears to be one of whether the air-cooled engine can be made to equal the water-cooled engine in these three characteristics. It has also been contended by the water-cooled proponents that the air-cooled engine must, due to its relatively large frontal area, have a much higher head resistance factor than has the water-cooled engine. These questions have been largely based on surmise. Little really definite comparative information has been at hand, for the simple reason that until very recently there have been no air-cooled engines of any

*Testing Fuels for High-Compression Engines, by Stephen M. Lee and Stanwood W. Sparrow. See S. A. E. Journal, Vol. 12, No. 1.

*For example, benzol has a tendency to solidify at cold temperatures.

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considerable output available in this country for actual comparative flight tests.

Something over two years ago, we began in real earnest an intensive development and testing program to determine definite answers to these questions. The first requirement was of course to get, for flight service, an air-cooled engine which would have an output comparable to more commonly used water-cooled engines. Five engines of an exceptional type—the Lawrance Model J—a convenient nine-cylinder radial—having a rated output of 200 H. P. at 1800 r. p. m. were contracted for, for development purposes.

The first of these engines was completed about eighteen months ago, was placed on a test stand, and test running begun, mostly at wide-open throttle. I won't burden you with the details of these tests. The thermal characteristics of the engines as originally designed proved to be entirely sound and to require no modification. A number of mechanical troubles developed, however, as tests continued, involving changes in crankcase design, crankshaft and main bearing design, cylinder securing, valve springs, cams, accessory drives, propeller hub, and all manner of minor details. Parallel with these block tests, sample engines have been in actual flight service for a period of nearly a year. The same engine has been flown in weather ranging from the hottest days of summer to the coldest days yet encountered this winter (16° F.); from sea level to 20,000 feet; in dry weather and rain; in parallel service with the best water-cooled engines of comparable power which we know of today. Troubles have been encountered to be sure, *many* troubles, but they have almost invariably been troubles of a mechanical nature, and without exception means have been found for overcoming them. Not one instance of trouble of any nature has been found which has been at all inherent in the fact that the engine was air-cooled rather than water-cooled. We have found no indication in any of our tests during more than two years of constant running of engines of this type that the air-cooled engine as such is less efficient, less flexible, less powerful, less dependable, less durable, or more sensitive to changes in altitude or in temperature, than is the water-cooled engine. It is certainly lighter than the water-cooled engine with its radiator, it requires less preliminary running to warm up in cold weather, less attention on the part of the pilot in flight, and its installation is distinctly simpler and cheaper.

To gain an indication of the relative aerodynamic features of the air-cooled and water-cooled types, we have built for comparative flight tests three types of airplanes which are exactly alike in all respects except for the power plant installations. One of these types has the air-cooled engine installed, the other two types have two different models of water-cooled engines. Two of these airplanes, one equipped with the Wright Model E-2 water-cooled engine and the other with the Lawrance Model J-1 air-cooled engine, were entered in the Detroit races this year. Unfortunately, the water-cooled type did not finish due to a broken propeller tip which forced her out of the race. But from comparative flight trials prior to the race and from recorded times for the early laps of the race, it is pretty conclusively established that the two machines, using identical propellers turning at the same r. p. m. were exactly equal in speed.

The power output of the E-2 engine was brought up to that of the J-1 engine by installing in the E-2 special high lift cams and special pistons to give a compression ratio of 6.5 to 1. The J-1 engine was in all respects standard.

I regret that our testing program in this regard is not yet completed, and that complete quantitative data are not, therefore, yet available. All information as yet available, however, appears to confirm the results noted during the Detroit races.

The wide investigation that we have pursued during these past two years appears to have established beyond the range of surmise the following characteristics for the air-cooled engine of smaller powers up to, say, 300 H. P., as compared with the best existing types of water-cooled engines of comparable power.

(a) There is nothing inherent in the air-cooled engine that renders it less durable or dependable as a mechanism than is the water-cooled engine.

(b) As regards thermal characteristics, the air-cooled engine is at least the equal of the water-cooled engine. Block and flight tests over a period of many months have demonstrated a specific power and specific fuel consumption which is the equal of the best water-cooled engines of comparable power which we know of.

(c) The air-cooled engine is not unduly sensitive to wide changes in atmospheric temperature in flight service.

(d) The head resistance of the radical air-cooled engine of the largest size that we have had in flight, 43-in. diameter overall, is not greater than that of the water-cooled engine of the same power plus the necessary radiator.

(e) The air-cooled engine is much more quickly warmed up and made ready for flight in cold weather than is the water-cooled engine, and will withstand long glides and dives at high altitudes without interfering with its operation.

(f) The air-cooled engine requires less attention on the part of the pilot than does the water-cooled engine.

(g) The weight of the air-cooled engine is unquestionably inherently smaller than that of the best water-cooled engines with its radiator and water. In this connection, I have prepared Figure 6 to show at a glance a comparison between the dimensions and general characteristics of two actual types now in general use in our service, the Lawrance Model J-1, air-cooled, and the Wright Model E-4, water-cooled. The data shown in this figure represent actual test data for the most recent models of each type. Weight data for each type are based upon *dry* engine. The water and radiator of the water-cooled engine is not included. This represents an additional handicap in favor of the air-cooled type of approximately 6 lbs. per H. P.

The conclusions to be drawn from these facts—and they now are fully demonstrated facts, not surmise—are perfectly obvious.

What are the possibilities in air-cooled engines of larger powers, remains to be determined. The Engineering Division of the Army Air Service has in its excellent research at McCook Field demonstrated the entire practicability of construction air-cooled cylinders of large displacement which have thermo-dynamic characteristics equal to the best water-cooled construction. It remains only to solve the relatively simple mechanical details of combining such cylinders into a larger power engine without exceeding reasonable frontal dimensions. How large diameters are practicable before the head resistance factor of the conventional radial engine becomes an offset to the other inherent advantages of the air-cooled type is a question that can be decided only by actual flight trials which must naturally wait upon the development of larger air-cooled engines which are now being projected. The question of frontal dimensions is largely a question of mechanical arrangement. We are now investigating valve arrangements which will permit very material reduction in radial engine diameters through the elimination of the top hamper now used in conventional overhead poppet valve cylinder designs. A highly experimental engine is under construction which entirely eliminates the overhead valve gear, there being nothing at all above the cooling fins of the cylinder head proper. It is too early to predict the outcome of this project, but the advantages to be gained not only in the way of head resistance, but in overall weight as well, are self-evident.

The air-cooled engine, at any rate in the smaller sizes, has definitely arrived, and is in our service definitely displacing the water-cooled engine in all sizes up to 300 H. P. No new types of water-cooled engines in these powers are contemplated.

What the future is for air-cooled engines of larger powers we are not yet prepared to say definitely, but the prediction is ventured that just as the air-cooled engine is now displacing the water-cooled types in the smaller powers, so will it extend its field progressively to the larger powers and displace the water-cooled engines in this field.

I have outlined only the more important work that we have been doing along more or less conventional lines—namely in the four-stroke Otto cycle reciprocating engine. These are the things of the present and the immediate future. That we have not confined ourselves to convention alone, you may be sure. Many other lines have been or are being investigated. I have refrained from mentioning investigations that we have been making along other lines, for example, in high speed solid injection auto-ignition engines, in two-strokes cycle engines, and others, because all of this work is still in its preliminary stages and is still too full of conjecture to warrant definite predictions for results as applied to actual aircraft use. It is not to be doubted that radical departures from present conventional practices will, soon or late, gradually or suddenly, find their way into the aviation field, but as yet no new departure has presented itself which appears to give promise in the immediate future of displacing the present more conventional practices in common use. Our chief hope for betterment, so far as the present is concerned at least, lies in perfecting the kind of apparatus that we have been accustomed to using. And in looking back over the results of the recent development work that has been done with the funds which have been made available to us, we feel that the funds have on the whole been spent to good advantage, that safety, dependability, and operating cost of aircraft have been very materially improved, and that the strong commercial aircraft industry which the national defense so sorely needs is thereby much closer to realization than it has ever been before.

APPENDIX I.

The Influence of Power Plant Weight on Transportation Costs

One often hears the statement that the requirements for Commercial Aviation

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are quite different from those for military aviation, that for Commercial Aviation one can afford to use considerably heavier engine types than are at present in common use for military aircraft. A rather careful study of the influence of power plant weight on the amount of pay load that may be carried throws some interesting light on this subject.

I have taken a basis for comparison the performance of a type of aircraft which has recently been developed, and which has an unusually high carrying load per H. P. by comparison with existing types of aircraft.

The total gross weight of the machine as built is 7175 lbs. The engine used is a Standard Liberty developing 400 B. H. P., which gives a power loading of 17.9 lbs. per B. H. P., a very satisfactory figure.

With a cruising radius of 500 miles this plane as built can carry a pay load of 1010 lbs.

The power plant weights are as follows:

Dry weight of Liberty engine	872 lbs.
Engine accessories	58
Starting system (hand starter)	17
Propeller	58
Cooling System (dry)	132
Cooling water	113
Oil System (dry)	33
Fuel System (dry)	184
Engine controls	15

Total power plant weight, (excluding fuel) .... 1462 lbs.

As a basis of comparison, I have taken a purely hypothetical assumption that there is available to replace the Standard Liberty engine, an air-cooled engine which will deliver 400 H. P. and which will weigh 600 lbs. dry. I believe that such an engine is quite capable of being manufactured.

With such an engine it is reasonable to assume a power plant weight of:

Engine	600 lbs.
Engine accessories	33
Starting system	17
Cooling system	0
Water	0
Oil system (dry)	33
Propeller	58
Fuel system (dry)	184
Engine controls	15

Total power plant weight 940 lbs.

(excluding fuel which is assumed to be the same for both cases.)

Owing to the simpler engine mounting required for the air-cooled engine, there will be an additional saving in weight which is conservatively estimated at approximately 50 lbs.

The total saving in power plant weight in the case of the latter installation is therefore—

1426—940+50=572 lbs.

This saving in dead weight of the power plant permits an increase of 572 lbs. in the pay load, without in any way affecting the performance characteristics of the plane.

Assume that a commercial transportation company has a regular contract to carry 3000 lbs. of goods per day, a distance of 500 miles.

To fulfill this requirement it will be necessary in the first case to keep three airplanes in continuous operation, while with the light power plant the same work can be done with only two planes, and the relative transportation costs per ten mile will be 50% greater when using the heavier engine than when using the lighter engine.

The Development of Lighter-Than-Air Craft

IN AN address before the Affiliated Technical Societies of Boston at Tremont Temple, Mr. Edward Schildhauer, E. E., of the National Aeronautic Association of U. S. A. discussed the development of lighter-than-air ships, in which he brought out some unusual features concerning airships for commercial transportation. Mr. Schildhauer is a world authority on airships, being the Chief Engineer of the American Investigation Corporation, and he also achieved fame as the Chief Electrical Engineer of the Panama Canal, being the designer of the electrical equipment operating the locks and towage systems employed at the great water-way.

The meeting of the Affiliated Technical Societies of Boston was designated Commercial Aviation night, and other speakers were Professor E. P. Warner, Aeronautical Engineer of the Massachusetts Institute of Technology, and James T. Williams, Jr., Editor-in-Chief of the Boston Evening Transcript,—the meeting in particular being held in connection with the opening of a landing field at East Boston, to be known as "Boston Air Port."

"In comparison with Endurance flights of airplanes," stated Mr. Schildhauer, "the airship leads by a tremendous margin. The world's endurance flight of heavier-than-air craft is between 35 and 36 hours, and the greatest distance in single flight record of such craft is a little over 2,000 miles; while in the case of airships, the German Rigid L-59 during the war made a trip from Jamboli, Bulgaria, to a point beyond Khartoum, Africa, and return, in 95 hours, and travelled 4,500 miles. The British Rigid R-34 crossed the Atlantic, remaining in the air on the trip to America over 100 hours, and flew over 75 hours on the return journey, while airships of even smaller dimensions have remained over the North Sea for more than 100 hours at a stretch.

"These feats of long distance endurance flight made by airships", continued Mr. Schildhauer, "point to the airship as the supreme vehicle for long distance aerial transportation. Heretofore the modes of transportation have been limited by terrain: the wonderful railroad systems have come to an end at the seaboard, where connections may be made with ships. The airship, which uses the air as a pathway, has no such limitations. It therefore follows that the best seaport may not necessarily be a convenient harbour for airships. Generally, there are advantages in combining the facilities of a seaport with an airship harbour, but, on the other hand, an inland city may have other facilities and advantages which outway the favorable points of the seaboard city."

Mr. Schildhauer brought out the fact that in studying the future development of airship transportation in America, giving due weight to the present transportation facilities, the conclusion seems to be that Chicago is a logical location for a main harbour. From the standpoint of national defense, Chicago also is in a favorable position."

Chicago, he pointed out, has made a start toward the establishment of an airport, but, like other cities, has not yet been able to arouse the public to the great advantages accruing to any nation which is first in the field in the development of airship transportation. The path of an airship is not limited by the banks of a lake or the shores of an ocean, and as a consequence the theoretical path between two cities may be in a straight line. The shortest airship route between Chicago and Moscow, for instance, passes over the northern part of Labrador, the central portion of Greenland and Norway, over Petrograd, then southeast to Moscow—a total distance of approximately 4,800 miles. A route from Chicago to London would pass over the southern portion of Labrador and a few degrees south of Greenland—a total distance of about 3,800 miles. The Chicago-London route, via New York and Boston, is only 180 miles longer; therefore, it should be expected that even though the trans-Atlantic ships would start from Chicago, they would stop at New York and Boston to take on passengers and express matter, together with fuel and supplies at Boston.

Going west, similar conditions exist, as shown by the route from Chicago to Tokyo and Manila, which passes over the central portion of Alaska, thence touching Kamchatka, and following the group of islands to Tokyo—a total distance of 6,000 miles, whereas the distance from Chicago to Tokyo via Seattle is only about 200 miles longer.

Just as benefits accrue to the nation first in the field of airship transportation, so they will apply to favorably

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located cities in America, and in spite of some disadvantages, it is within the realms of possibility that Boston will become the preeminent airport of America, if the proposition is prosecuted in a comprehensive manner. Boston is well situated for an eastern terminus, as the manufacturing towns of high-grade articles are within easy reach of Boston by means of airplanes. In explanation of this, Mr. Schildhauer stated that airship and airplane harbours should be located as closely as possible to present centers of activity and facilities for surface transportation. It should be a combined airship and airplane harbour, because there is no question in the mind of those who have studied aerial navigation that the time will soon arrive when the principal high class transportation will be done by means of aircraft, both lighter and heavier-than-air.

"It is my opinion", he continued, "that safe night flying by airplane has not yet been solved, but it is entirely solved by the use of airships. Therefore, in order to put 'America First in the Air', night flying should be done by airships and the schedule so arranged that the landing will be early in the morning so that, from the same field, airplanes will take individual passengers, or groups of two or four, to the outlying districts and cities within a radius of 200 to 250 miles, arriving at their destination early in the forenoon. This can also be done, of course, in the case of high class express matter and mail by the employment of airplanes in conjunction with airships.

"While Boston may become the eastern terminus, it is not as well situated for the purpose as the metropolis of the middle-west—Chicago. In fact, no Atlantic coast city is so favorably situated; and in order that Boston may reap the benefits of aerial transportation, it should start at the earliest possible moment to lay out a harbour on a comprehensive scale, and induce aircraft companies to utilize the field, thereby building up the industry and gathering the lines in the early stages, to form the nucleus of future growth."

In speaking of the progress of airships for commercial purposes, Mr. Schildhauer called attention to the remarkable performances of the German Rigid Bodensee which, with accommodation space for 24 passengers, in 1919, until stopped by the Allied Powers, operated for 101 days, and carried 2,380 passengers between Berlin and Friedrichshafen, making practically 98% of her scheduled trips. "In fact", said Mr. Schildhauer, "European airship development has progressed within the last decade from the experimental stages to an accomplishment whereby passengers may be transported safely over long distances, and follow a predetermined schedule. Thousands of passengers have been transported in passenger airships in Europe, and not a single casualty has occurred.

"In the United States, with helium as a buoyancy medium and the employment of the mooring mast to obviate the danger of handling ships on the ground (a measure which also reduces the expense of operation), there can be no question with respect to the desirability and the safety of airship navigation on a grand scale. Engine improvement, luxurious and comfortable quarters for passengers, highly developed navigational instruments, and the ability of airships to maneuver around or above local storms, make it a foregone conclusion that such ships will be in operation in this country in a very short time, for not only will a needed adjunct to present transportational systems be provided, but the problems of national defense will be correspondingly simplified."

In conclusion, Mr. Schildhauer urged that a general campaign for enlightening the public on this very important economic factor in the nation's transportational needs should be immediately put into effect, because what this country needs even more than landing fields and airports is public confidence and interest in aviation generally.

The Helicopter

A Review of the Latest Book by M. Margoulis, Former Director of the Eiffel Laboratory

By William Knight M. E.

If the only subject of the helicopter was to rise from the ground and to remain stationary in the air, this machine would probably be useful in connection with military operations only. In fact the first realizations of helicopter designs which made their appearance during the war had in view mainly the utilization of this new type of aircraft as a substitute for the observation balloon.

Later on, however, the trend of evolution of helicopter design has developed the commercial possibilities offered by this new type of flying machine and a number of types have been built with multiple propellers providing for the vertical and the horizontal displacement of the helicopter in the air. The question has since arisen as to the practicability of designing and building helicopters which besides being able to rise vertically in the air and to fly horizontally at any desired altitude and in any direction, can also be favorably compared to the airplane in so far as speed, useful load and fuel consumption are concerned.

In order to answer this question, what was needed was a basis of laboratory experimental work and an analytical method of approaching the problem. This has been supplied by the author in his book on "The Helicopter" recently published in France.

The experiments made by the author after 1918 at the Eiffel Laboratory and at the St. Cyr Aerodynamic Institute have enabled him to plot for the first time the general characteristic curves of a propeller for any position of its plane of rotation with reference to the trajectory of the aircraft. Also, he has devised a new graphical method of representation of experimental results obtained by others on propeller research work, which has thrown a considerable amount of light on the real meaning of a large amount of experiments made both in Europe and in this country which have been so far the object of many discussions and interpretations.

In the second part of his book, the author takes up the mechanics of the helicopter flight and he applies the experimental knowledge which he has reviewed, interpreted and co-ordinated in the first part. The vertical, the horizontal and the inclined regime of flight are considered in this second part of the book.

The comparison between the regimes of flight of an helicopter and of an airplane is established by the means of "polars" which so far have been mainly used in connection with the graphical representation of the aerodynamic characteristics of air-

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plane wings. The graphical method used is the same which has been previously developed by the author in connection with the mechanics of the airplane flight.

One of the conclusions arrived at by the author in his book is that the hopes which have been based on the braking effect of propellers rotating as wind mills in checking the fall of an helicopter in case of a sudden stop of the motor, are not well founded because the velocity of the descent of the aircraft under these conditions would not be sufficiently retarded so as to insure a safe landing.

The study of the horizontal flight of the helicopter leads the author to the conclusion that, for the same horizontal speed of displacement of the aircraft in the air, the power required by the helicopter is greatly in excess of that required by an airplane. However these conclusions would have pointed out to a more favorable comparison between these two types of aircraft if propellers of a smaller pitch than those considered by the author had been figured upon in the calculations.

The study of gliding flight of helicopters, is referred to the case of an helicopter equipped with sustaining wings, and the graphical method used in the analysis of its performance is due to Prof. Joukowski and to the author. This analysis shows that, same as in the case of an airplane having a great excess of power, a regime of flight (unknown up to the present time) exists which offers a number of peculiar characteristics, as for instance, the reversal of the action of control planes.

The discussion of the various problems related to the mechanics of helicopter flight has been developed by the author in a very general and most comprehensive way, especially due to the introduction of graphical methods of calculation and to the use of transparent sliding diagrams which have been developed by the author and which constitute a great contribution to the art of nomography.

Both from the point of view of experimental aerodynamics and from the point of view of nomography, Mr. Margoulis' book on the helicopter is extremely interesting and useful.

Most of the work contained in this book and especially the analysis of experimental research work on propellers contained in the first part of the book (pages 1 to 36) and the first chapter of the second part dealing with the mechanics of the vertical flight of an helicopter (pages 45 to 51) were first presented by the author in the "Technical Review of Aeronautics" issued monthly by The Paris office of the National Advisory Committee for Aeronautics and edited by that office as a confidential technical report on aeronautical progress in Europe. The publication of this review was discontinued in 1921—copies of this review are now filed in the libraries of aeronautical technical organizations in Europe and the National Advisory Committee for Aeronautics, Washington, D. C.

"The Helicopter" by W. Margoulis, former Director of the Eiffel Laboratory, Paris, published by Gauthier-Villars & Co., Paris, France.—31 pages, 21 diagrams.

Modern Air Transportation

By W. Wallace Kellett

An Airline is very much like a railroad. In both cases the object is the same—transportation. Both require terminals, a route, rolling stock and trained personnel.

Every one knows in a general way the tremendous organization, efficiency and accuracy necessary to the operation of a successful railroad. When traveling, however, we rarely think of the roadbed, the steel rails, the block-towers, switches and the host of men who are personally connected with every movement of every train.

So with the Airliner. Some of the passengers on the London-Paris Airliners recently asked why the pilot was continuously talking to himself while they were in the air. They could hardly believe it when told that the pilot was not talking to himself, but with Paris, London and the other ground stations on the route by means of the wireless telephone with which all these liners are now equipped.

This is only one of the marvels of the airlines. By wireless, the pilots receive full reports of weather and flying conditions all along the route and can also ask for any information they desire.

Photographs showing the guide board for the use of pilots and officials at the LeBourget Airport, Paris, are perhaps the finest evidence of the high state of efficiency which has been reached in the operation of Continental Airlines.

By a glance at this board the pilot can tell just what kind of weather he will have on his day's trip and how long it will take him to reach his destination. In the upper left hand corner is the tableau for the Paris-London, the Paris-Brussels and the Paris-Amsterdam route.

The following indications appear on this tableau—the weather at the time, the weather predicted and the "air soundings" telling the velocity of the wind and character of the air at different altitudes.

These reports are sent in hourly by radio from all the stations on the route. They are made by men who have experience, know their business and can be counted upon not to err.

In the lower left hand corner is the tableau for the Paris-Strasburg route. The "Observations", "Previsions"

The "arrival" and "departure" boards at a French airport

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and "Sondages" are easily distinguished on this tableau.

In the center is the great map showing all the cities on the Continent and in England traversed by the Paris air-routes.

The clock dial in the upper left hand corner shows the time of the last report.

The arrows indicate the direction of the wind in each city. The small disks on the arrows tell by their color the exact state of the weather.

The small white tags hanging from the arrows state the exact ground velocity of the wind.

Even a person quite unfamiliar with the system can understand this map after a few minutes study.

To the right of the map is the cloud-tableau. It also has a clock dial in the upper left hand corner indicating the hour of the last report. The reports, incidentally, are made hourly.

This tableau tells the altitude of the clouds at the various points along the route. This is very important, as pilots must know whether they may fly above the clouds with safety or must fight their way through beneath low clouds, and in the latter case, how long these low clouds will continue.

The cloud tableau indicates cloud altitudes up to 6,000 ft. The altitudes are indicated by the height of the light strips which are read by means of the scale on the left hand side.

On the day this photograph was taken the height of the clouds varied from 1500 ft. to 6,000 ft. Where a strip is entirely covered by the dark shutter it means that no report has been received during the hour from the town represented by that strip.

Finally, the small bulletin board on the far right gives special indications to pilots concerning conditions at the air terminals such as, for example, soft ground due to rains, part of the field occupied by workmen, temporary obstacles such as grass mowers, which must be avoided, etc.

Information charts and maps used at the Le Bourget Airport

The second illustration shows the entire flying-board at LeBourget. It gives an idea of the compactness, simplicity and completeness of this installation.

It is equipment of this kind which forces us to realize what the operation of an airline really means.

The indications which appear on the flying boards at Paris, London, Brussels and the other European Airports are not the result of magic. They come from thousands of dollars worth of special equipment, a trained personnel and last but not least, the experience of four years operation of commercial air transportation lines.

The boards showing the "Departs" (Departures) and the "Arrivees" (Arrivals) are also interesting. Each machine which arrives at, or departs from the airport is recorded on these boards.

First is given the name of the airline to which the machine belongs then come in order, the license number of the machine (all airlines must have Government licenses), the destination to which it is flying, the time of departure, the time of landing, the cargo it carried, and last the location where it landed, expressed simply by the word "Arrivee" if the machine reaches its scheduled destination without stop, as is usually the case.

So we see that it takes a great deal of equipment to make an airline. Even now we have considered only a small part of the necessary material.

The Cycle Theory In Flying

NOTHING new under the sun. It's always been already done. Trade Cycles, cycles in flying.

The air cooled engine is coming in for interest as a new development and the prophecy is made by a prominent manufacturer that in four years practically all aircraft engines will be air cooled. Yet little more than a decade ago, say thirteen years back, the best known and most successful engines were all air cooled. The Gnome dominated the field.

Balloon observers of 1918 thought they were participating in a new phase of warfare. Count Zeppelin watched our military balloons in 1861; and they were used again in 1898.

The Army airship flew over New York in 1922. Solomon Andrews did it in 1863.

1922 Model Airway towns advertised themselves with air markings. In 1909 the word "Amherst" in 35-foot white letters marked the introduction of airway signs.

In 1923 the Bothezat helicopter built with great secrecy by the Air Service, proved that Newton Williams and Emile Berliner were right in 1909, by duplicating their achievement.

The Government's little known but much discussed manless automatic airplane of the period 1918-1923, was much more fully described by Emile Berliner in 1909, whose device had all the features of the machine of today.

Well, how about night flying. They certainly didn't do any of that stuff in the dear, dead days beyond recall. Well, Noah, and Jonah and Cap'n John Smith didn't for a fac'; but Charlie Hamilton did and is probably sittin' on the same cloud spielin' about what *he* used to do at Camp Dickinson, in 1910.

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Federal control of flying and we're all het up over a bill that doesn't seem to pass. The Department of Commerce, it seems, decided in 1914 that flying boats, at any rate, were "vessels" when they were on the water and demanded they meet requirements. Licenses were granted and fines imposed under the law.

Commercial transportation. Florida airways. Sure thing. Tony Jannus flew the old Benoist boat back and forth during the season of 1914 between Tampa and St. Petersburg at $10 a fare and made money.

Oh, but the X engine of McCook Field. W. Starling Burgess will be interested in this, for he built one of 'em in 1914.

Hundred per cent performance for the Air Mail. Chief Egge deserves all the credit in the world. The Air Mail is the greatest flying demonstration ever put across. But the idea is old. Air mail, trans-atlantic, was proposed to this country by a German airship inventor in 1902. In 1908-1909 Senator Sheppard urged air mail. In 1911 Postmaster General Hitchcock inaugurated an honest-to-goodness service on Long Island, with Earle L. Ovington as first pilot, making scheduled trips between two post offices with one hundred per cent efficiency for the week.

Modest Modesto, Calif., provided in its 1911 charter for a municipal aerodrome "when needed," and Kissimmee—don't laugh—, in Florida, booked the first American, at least, aircraft ordinance, in 1908.

The Germans last year made some wonderful straight gliding records. Maloney, in the Montgomery machine, in 1905, did acrobatics from 4000 feet height, having cut loose from a balloon, used to get a little altitude for the start.

Gas bombs from aircraft are being figured on for the next war. Tony Jannus thought of gas from airplanes when he took Bert Berry up at Jefferson Barracks, in 1912, on the world's first parachute drop from a plane, and told the press about it.

Speaking of parachutes, parachute jumping with the shoulder pack was an old story by the end of that year and in 1923 the Government is defending the suit of an inventor. The original parachute jumper however was Sebastian Lenormand who jumped off a tower with a big umbrella in each hand, the day after Christmas, 1783.

Muffled engines for commercial lines, when established, are being considered. The Army used 'em in the Burgess machines of 1912.

Aerial photography a development of the war? Exactly. But Bob Fowler used to take 'em with a motion pitcure camera on his transcontinental flight in 1911.

Transcontinental flights were getting common then. This was the second one. Cal Rodgers had already ended his.

The newest types of aircraft engines now have starters. Starters were the mode in 1911.

The enemy wasn't worried much in 1918 by American archies. They were comparatively new. We had had them only 9 or 10 years, since Dr. McLean demonstrated one in Cleveland in 1909 and the Army and Navy had each built their first experiments in 1911.

Here's Earl Findley goes and leaves the Air Service flat and sets himself up as editor of the newest air magazine. There's nothing new in that. Not for Findley, there isn't. Findley was writing aeronautical beats in 1908 for the New York Tribune; and the first American aviation magazine—yes aviation; for it dealt mostly with heavier-than-air dope—was the "Aeronautical World" helped along by Chanute in 1902 and just about as successful as the Bothezat helicopter.

And these ain't all, neither!

Aerial Mapping By The Geological Survey

By C. H. Birdseye, Chief Topographic Engineer, U. S. Geological Survey

The Truth about Mapping—60 Per cent of U. S. Unmapped—Temple Bill Would Map by Air in 20 Years 1,800,000 Sq. Miles—Using Army and Navy Air Service Cost Reduced One Fourth—Improvements Needed in Cameras— Aerial Photos Will Not Supplant Ground Work—Need for Private Enterprises—Editor.

THE topographic maps of the country are made chiefly by the United States Geological Survey, which is charged with the work of making standard topographic maps in quadrangle form of the whole area of the United States. In this work, many States co-operate by furnishing funds to pay part of the cost. Special military maps are made by the Corps of Engineers, but duplication of work is prevented by close co-ordination between the two organizations. The Engineer Department of the Corps of Engineers and the Mississippi River Commission make certain topographic maps of areas, primarily for river and harbor improvements. The Forest Service and the Reclamation Service make special topographic maps, but only of areas where the Geological Survey is unable to do the work on account of lack of funds and personnel. Cadastral maps and plats are made by the General Land Office, particularly to show the results of the public-land surveys. The United States Coast and Geodetic Survey is making hydrographic surveys of our coastal waters and publishes this data in the form of charts designed primarily for use in navigation. The Hydrographic Office of the Navy Department makes similar surveys and charts of contiguous and foreign waters. The United States Lake Survey makes hydrographic surveys and publishes hydrographic charts of the area of the Great Lakes.

Almost every bureau or office of the United States Government uses maps, plats, or charts, but most of these organizations do not make them, they use the base maps, plats, or charts prepared from field surveys made by the principal Federal map-making agencies.

The area of the continental United States, exclusive of Alaska, is about 3,000,000 square miles, about 40 per cent of which has been covered by topographic surveys whose results are published by the Geological Survey in about 3,000 separate maps. There remains to be mapped about 1,800,000 square miles, and if the work is done at the present rate it will take more than a hundred years to complete the job. By that time at least 75 per cent of the maps will have become obsolete as regards cultural features and will need revision.

The Temple bill (H. R. 10057), now pending in Congress, authorizes the mapping of the entire unsurveyed area in twenty years. In connection with this project the fullest possible use of aerial photographs has been planned, and their use will undoubtedly make a large saving in both time and cost,—how large depends on the amount of co-operation that the flying services can give and on improvements in flying and photographic equipment. In its plans for this work the Geological Survey does not contemplate the creation of its own

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flying or photographic service. If the air services of the Government can, in connection with the necessary training of its personnel, photograph the areas to be mapped by the Geological Survey, the project will be expedited and the Government will save more than one-fourth of its total cost. If the Federal air services can not meet this need, and the Geological Survey has to make contracts with private aerial photographic firms for the service, the saving in cost will be problematical. Under the present conditions the cost of the work under such contracts would be prohibitive as ground surveys for maps on the scales used by the Geological Survey can be made about as cheaply as aerial surveys. Airplane photographs can not yet be used to determine relief, so that the field engineers must go over most of the ground in order to obtain the data for the contour structure.

Assuming, however, that the Geological Survey will have the hearty co-operation of the air services, we may say that the future of aerial photographic surveys in connection with topographic mapping is bright, and moderate estimates indicate that this assistance will save about 30 per cent in the cost of mapping.

Enthusiastic proponents of aerial photography have created a general impression that an accurate map of a region can be made by taking a number of airplane photographs and pasting them together. This operation, however, gives a distorted photograph of the ground, properly called a mosaic, which is not in any sense of the word a map, and unless the photographs are rectified and tied to well-established ground control a map made from them will contain serious errors. The topographic maps prepared by the Geological Survey are quadrangular units, each of which is an integral part of the topographic atlas of the United States. As these parts must fit together perfectly, they should contain no cumulative errors, such as those that are inevitable in surveys not based on accurate geodetic control.

Too many fliers and photographers who are totally ignorant of the fundamental principles of accurate map making have made enthusiastic claims that air photographs will completely do away with ground surveys. They have led many to believe that the United States can be completely mapped in an amazingly short time and at a cost that would be insignificant as compared with that of mapping the country by ground surveys. The result of this belief is that the mapping activities which are essential to the proper use of air photographs are being curtailed under the supposition that the "mosaic" will replace the results of ground surveys.

It is still impossible to map relief by means of airplane pictures. The topographic maps of the Geological Survey are essentially relief maps, the slope of the land and the differences in elevation being shown by contour lines based on spirit leveling reckoned from mean sea level as a datum. European scientists and experts of the Army Air Service at the experiment station at McCook Field are trying to devise a process by which relief can be shown accurately by airplane pictures, but so far with very little practical result. Such a process that will be commercially practicable may yet be devised, but only after many years of research and experiment. It is therefore evident that the topographer must go over the ground thoroughly enough to map the contours, and while he is doing this work he can, in many areas, meander the streams, roads, and trails without much additional cost. For certain areas therefore the only advantage afforded by airplane photographs will be an increased exactness in minor detail and a graphic record that will eliminate field inspection.

Airplane photography in topographic mapping will probably be of greatest value in the revision of old surveys. It is obvious that a more accurate and complete revision of the culture—the roads, railroads, buildings, etc.,—can be made by the use of airplane photographs than by additional field work, which is likely to be only fragmentary.

The methods employed and the results obtained in aerial mapping have not reached a point where the photographs can be used for making maps of all kinds, but the practical demonstrations made during the last three years by the Geological Survey have proved beyond doubt that they can be used extensively in connection with the topographic mapping of the United States on the scale of 1:62,500 (approximately 1 inch to 1 mile), except in rough, mountainous or heavily timbered areas.

Although, so far as the Geological Survey is concerned, airplane photography can not entirely supplant ground work, nevertheless it is the most valuable aid to topographic mapping that has been devised since the plane-table was perfected, and the Geological Survey proposes to use it to the fullest extent and to assist as much as possible with the funds available in the development of new methods and new instruments.

The Geological Survey made its first practical use of aerotopographic mapping in the survey of the Schoolcraft quadrangle,* in Michigan, in 1920. In this area, which includes 220 square miles, 273 photographs were taken by the Army Air Service. The total time consumed in the work was five days, including the time consumed in round trip flying from McCook Field. The actual time employed in taking the photographs was only seven hours, and the total cost of the photographic work, exclusive of the pay of the officers, was $712, or $3.50 a square mile.

The Geological Survey had already established the ground control and had made the base-map projection on which the control points were plotted and the land-line network adjusted before the photographs were used; and this is the correct procedure for maps of this class covering areas where the public land-line system is marked on the ground by roads or fences that will be shown on the photographs. The photographs were joined together in small mosaics, about four pictures to a mosaic. All the features on the photographs that would aid the topographer, such as roads, houses, streams, swamps, fence lines, and timbered areas, were inked on these small mosaics. The photographs were then bleached, leaving only the inked lines on the photographs which were on the scale of 1 : 15,000. These inked photographs were reduced by photography to the scale of the base map, 1 : 48,000, and were adjusted to the control and the land-line net laid down on the base map, fence lines in the photographs being registered over the section lines plotted on the map. Except at a few points a perfect adjustment was obtained. The combinations of small photographs thus made were then re-photographed and printed in non-photographic blue on field plane-table sheets and sent to the field for contour sketching by the usual ground methods.

The cost of preparing these field sheets was about $1.50 a square mile, so that the total cost of the photographic work was less than $5 a square mile. The wealth of detail shown in the photographs, such as the drainage, fence, and timber lines, enabled the topographer to make a great saving in the cost of the ground survey, which was $20 a square mile. The cost of the office drafting was $3 a square mile, so

* See Air Service Information Circular No. 184, "Use of Aerial Photograghs in Topographic Mapping."

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that the total cost of the survey was $28 a square mile. Similar work done in adjacent areas by the usual ground-survey methods cost about $40 a square mile, and the saving was therefore $12 a square mile, or 30 per cent. Here then, is the figure that indicates the average saving by the use of aerial photographs.

During the same year Bibb County, Georgia, which has an area of 275 square miles, was photographed to enable the Geological Survey to compile a county map for the Bureau of Soils. In this area, as there were no public land lines to use for the control of the photographs, the topographic engineers ran many control traverses to which the data taken from the photographs were adjusted. During the year 1922 the Memphis and Nashville quadrangles, Tennessee, and the East and West Cincinnati quadrangles, Ohio, were photographed by the Air Service at the request of the Geological Survey, so that the culture could be revised to date. Part of the Mississippi River valley near Reelfoot Lake, Tennessee, was photographed, and the data made it possible to map the area with very little ground surveying. An aerial photographic survey of Los Angeles County, California, is now planned for use in connection with detailed surveys being made in that county by the Geological Survey.

The first investigations in aerophotographic surveying undertaken by the Geological Survey were made by J. W. Bagley, of the Survey, now a Major in the Corps of Engineers who for nearly ten years employed the panoramic camera for topographic mapping in Alaska. Major Bagley undertook to adapt to topographic surveying in this country the principal features of a method conceived by an Austrian army engineer, Capt. Theodor Scheimpflug. This method differs from others in that the field of view of the picture is increased by employing a multi-lens camera, or a battery of cameras, for making a number of simultaneous exposures. Each photograph overlaps one or more of the others, so that the product is a composite photograph made up of all the others. The camera devised and employed by Major Bagley is a tri-lens camera. One lens is pointed directly down and the other two are inclined to it at a fixed angle. The distortion arising from the differences in the inclination of the axes of the lenses is corrected by an auxiliary rectifying or transforming camera, which, like the tri-lens airplane camera, was designed in the Geological Survey.

The work was hegun in the fall of 1916. Money for constructing the first airplane camera and the transforming camera was provided by the Council of National Defense, and the instruments were ready for trial in the fall of 1917. Major Bagley and Mr. Fred H. Moffit, of the Geological Survey, spent the end of 1917 and early part of 1918 at Langley Field, Virginia, in experiments with the camera. Early in 1918 the Corps of Engineers became interested in the work and provided money to build nine additional airplane cameras and seven transforming cameras, and from that time to the present the Corps of Engineers and the Geological Survey have collaborated in this work. Major Bagley was sent to France in 1918, and the investigations in airplane photography were continued by his associates Mr. Moffit and Mr. J. B. Mertie, of the Geological Survey. The first problem considered was that of stabilizing either the camera or a reference point or line from which to measure the deviation of the picture from its correct position. This work was done in collaboration with Lieut. W. A. Hyde, of the Science and Research Division of the Air Service, at Langley Field. A gyroscopically controlled airplane camera was constructed in January 1919, and was tested in a series of flights extending over several weeks. The results were encouraging, but owing to conditions that followed the demobilization of the Army, the work was not completed. The problem of stabilizing the reference point rather than the camera is now under consideration. Dr. L. J. Briggs, of the Bureau of Standards, was asked to assist in solving this problem and has devised an instrument, adapted to the tri-lens camera, by which a stabilized reference point is sought through the use of a gyroscope. Tests of this camera were made at McCook Field in 1921.

Air photographs will no doubt hereafter be used in all kinds of mapping and in solving some engineering problems, but before they can be of much practical value, other than in government map making, there must be greater facility for obtaining the use of privately owned aircraft, manned by specially trained fliers in order to obtain data by photographs at a cost no greater than that of obtaining the same data by ground work.

Airplane photography is in its infancy, but it will no doubt eventually become highly useful in making maps and will replace many of the ground methods now employed, but before it can do even this economically an immense amount of experimental work must be done in perfecting photographic methods and lessening the cost of photographic and flying equipment.

(*Concluded from page* 219)

open to inspection and only straight cables and levers without pulleys are used. The stabilizer is adjusted from the pilots' seat by means of a very simple worm gear, of which the actuating rods also pass outside the fuselage.

The cabin is probably the largest compartment yet provided on such a comparatively small plane. Including the entrance space and the toilet the total length of the cabin space is 14 ft., while there is sufficient head room for a 5 ft. 10" man to stand upright, the width of the cabin which is 5 ft. provides plenty of space for the two rows of 4 chairs which are normally fitted for passengers.

The cabin is well lighted by 4 large windows on each side, all of which can be slid open. Above the windows sliding ventilators admit clean hot air from a jacket surrounding the exhaust pipes when required. These pipes are carried way back of the cabin through which the noise is greatly reduced.

Behind the actual passenger cabin there is a kind of entrance hall in which considerable baggage can be placed or alternatively, another seat. After the entrance a very roomy lavatory is fitted up with the usual toilet, washing and drinking facilities.

The door is so close to the ground when the airplane is at rest that no step or ladder of any kind is necessary. There is a lock up baggage hold of 48 cubic ft. capacity, accessible only from the outside underneath the floor of the pilot's cockpit.

The fuselage construction throughout is on a completely new principle; the actual work is the usual Fokker welded steel frame construction, but the tubular members are built into wooden box members and the entire fuselage, with the exception of the engine section, then covered with 3 ply veneer which forms at once the covering, the bracing, and the cabin walls While the rigidity, practically indefinite durability and ease of repair which characterize the steel tube structure are in this way retained, all bracing wires which usually require occasional adjustment, and fabric, which on most airplanes requires replacement fairly often, are done away with.

The stabilizer is covered with veneer, like the wings which makes it very stiff and prevents any flutter. The elevators and rudder are of the usual Fokker steel tube construction and fabric covered. The same applies to the ailerons.

The landing gear is of a new type which has been fitted to all the most recent Fokker machines.

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Some Phases of the N. A. A.

By Conway W. Cooke

Chairman Membership Committee National Aeronautic Association of U. S. A.

NOT only the permanency but the actual functioning of the National Aeronautic Association depends in a large measure upon the number and strength of its local chapters. As a matter of fact every chapter of the Association becomes one of many similar local organizations linked and banded together into a complete and working whole through the medium of the Association's district and national headquarters. This affects a collective influence always exerting its strength toward the expansion of present national aeronautic activities into a great industry manufacturing and operating aircraft throughout the entire country.

A uniform effort on the part of local chapters wherever situated, either north, east, south, or west, harmonized and co-ordinated by the national and district headquarters into a smoothly working program will most quickly and efficiently carry out the purposes for which the N. A. A. was founded, those purposes being to foster, encourage and assist the development of commercial aeronautics in America for the following desirable ends: Prosperity in peace and security in war.

In last month's issue of *Aerial Age* will be found an official bulletin of the Association giving a memorandum on chapters with their by-laws and other data explaining the benefits to a community in which a strong chapter is located. It will readily be seen that through the chapter committees every civic, business, professional and social organization in the community puts its shoulder to the wheel and directly assists in the advancement of aeronautics as a local problem.

But, in addition, through the system of organization employed by the Association every chapter receives the moral support of the national and district headquarters and hundreds of other chapters engaged in the selfsame mission. Thus the influence of every chapter extends far beyond its immediate vicinity until it reaches throughout the entire country. This makes for a powerful organization, one which can even *demand* that proper measures be taken by cities states and the Nation for the safe and sane regulation of air navigation.

Every chapter being a unit of the national organization, through the national standing committees, can secure for itself a share in all of the activities of the Association, including the service of a speakers' bureau, the licensing and regulation of contests and meets, the dissemination of aeronautical information, and the thousand and one activities which the Association as a national body undertakes for the general welfare.

It will be readily understood that the organization of the N. A. A. along these lines is an undertaking of great magnitude and that the organization of local chapters throughout the country is a problem requiring the earnest co-operation of all those interested in aeronautical affairs. Consequently, as the most logical immediate solution of the problem in hand, the N. A. A. is now conducting a nation-wide campaign for membership and the establishment of local chapters throughout the districts.

Campaign committees have been organized in the districts and such prominent men as Colonel Edgar S. Gorrell, President of the Boston Marmon Company; Charles A. Moffett, President of the Gulf States Steel Company, Birmingham, Ala.; Samuel M. Felton, President of the Chicago and Great Western Railroad; Joseph Pulitzer of St. Louis; Dr. Frederick Terrell, President of the City National Bank of San Antonio; Cecil B. De Mille of Los Angeles, and others have accepted the chairmanship of these committees.

All these committees, together with experienced organizers in each district, are preparing the ground for an intensive personal-contact campaign during the month of May, when local chapters will be organized in the cities and large towns from coast to coast. This movement is meeting with the heartiest enthusiasm throughout the country and cities are now competing with each other in an effort to gain for each city concerned the largest local chapter in the Association.

It is hoped by the officers and present members of the Association that each reader of *Aerial Age* will peruse the bulletin, particularly the memorandum on chapters, with the avowed purpose of fitting themselves into the particular committee or phase of work of their local chapters which they find most agreeable, and thus assist in making the membership campaign a success. By so doing they will be placing their own community on the aeronautical map of the country, and also joining in the efforts of the Association to make its slogan "America First in the Air" a reality.

The Bristol Bullfinch—a new acquisition of the British Air Ministry

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N. A. C. A. Control Position Recorder

IN the study of airplane stability, controllability and maneuverability a knowledge of the position or movements of the control surfaces is essential. Heretofore, the method was to visually read the angle. This was slow and inaccurate. The device built by experts of the National Advisory Committee for Aeronautics gives more data in a few minutes than could be obtained by old methods in many hours. Even the cost of research has been reduced.

Another use of the instrument is for the study of control movements in various kinds of maneuvers. This is quite important as a pilot usually can not remember exactly how he moved his controls in order to execute a given stunt. Many know what they do but find it difficult to describe to a layman, or even to a flight student.

This instrument may be utilized simultaneously with the Committee's air speed meter, control force meter and the accelerometer, with the positions of the controls, the speed, the forces acting on the controls and the loads at a plurality of locations all recorded photographically, furnishing a complete chronology of any maneuver.

The record produced by the control position recorder illustrates simultaneously every movement of the rudder, ailerons and elevator during any period of time in any operation. The student has a photograph of the "stick" at each portion of a maneuver.

A comparison of ability may be had. The new student, or the applicant for a flying certificate from a school or from the Government should a federal bureau be organized, can see a photographic record of his execution of a maneuver alongside the record of a skilled pilot.

The instrument consists essentially of a base plate and film drum used on all N. A. C. A. recording instruments. A consistant speed clockwork driving motor (1) rotates the film clutch (2) at a speed of about 1 r. p. m. through worm gearing in

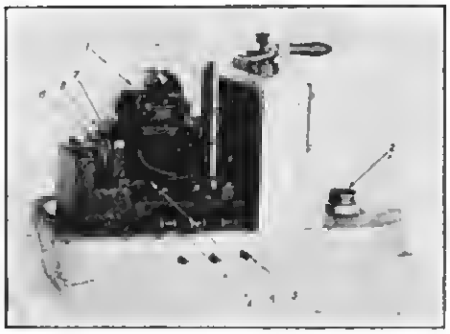

Fig. 1

the base. The motion of the controls is transmitted to the instrument through the cords (3) which are wrapped around three drums (4). The drums are mounted on a horizontal screw and contain a spiral spring which keeps the cords wound tightly. Thus, a 12-inch motion on the end of the cord is converted into a 3/16 inch lateral motion of the drum. This motion is transmitted by a system of levers (5) to three mirrors (6) which reflect the light beam from a tungsten lamp onto the moving film through the lens (7) in the same way as with other N. A. C. A. recording instruments. Three separate records are superimposed on one film, a continuous line, a dotted line and a dash line, accomplished by revolving slowly in front of two of the mirrors a sector shutter (8).

The cords can be connected directly to any convenient portion of the control system, but if it is desired to have a high degree of accuracy, it is advisable to run small steel wires to the control horns so that any backlash in the control systems may be eliminated. If this is done, a precision of 1/4 degree can be easily obtained, and this is quite sufficient for any ordinary work. The instrument is calibrated in place by setting the control surfaces to given angles and taking a short record on the film for each setting.

Some records taken by this instrument mounted on a JN4H, are shown in Fig. 2. Although they are not as clear as the original film the different records can be distinguished. The curves are usually re-plotted by measuring the distances on the film from the zero line and then multiplying by the calibration constant to give the true angle in degrees. These angles are then plotted against a time base so as to agree with the records from other instruments. The record of the landing shows the three-second vertical timing lines placed on the film by a light in the instrument case which is connected, together with timing lights in other instruments, to an electric chronometer.

In Report No. 112, "Control in Circling Flight," published by the National Advisory Committee for Aeronautics, there is summarized a great volume of work done in the investigation of forces and positions of controls and in the obtaining of data on behavior of an airplane in turns.

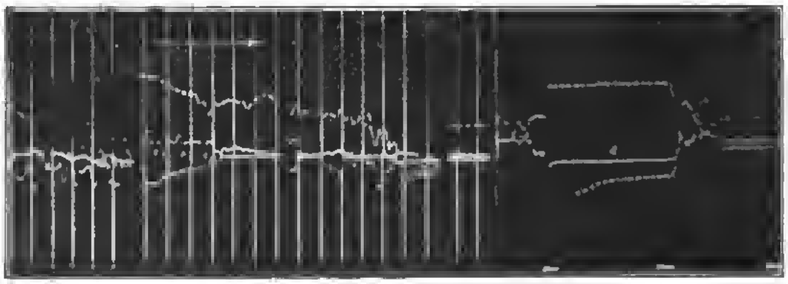

Fig. 2

Sand Point Aviation Field

Sand Point aviation field, Seattle, Wash., has a total area of 269 acres of which 40 acres is cleared and in condition for flying. This cleared area comprises a strip 500 feet wide and about one-half mile long north and south. There are no obstructions, the water being directly in front of the north approach and southeastward of the south approach. Owing to the prevailing wind there is no cross wind.

The Army Air Service has arrangements with the navy to use Sand Point Field for peace-time flying activities and has sent an overseas steel hangar to the field, which is now in process of erection. This hangar will be placed on the water so that it will be available for both sea planes and land planes; it should be ready for use not later than May 1, 1923.

Major H. C. K. Muhlenberg, Army Air Service, who is in charge of the R. O. T. C. Air Service, University of Washington, lives in the field quarters.

Approx. position: 47° 41′ N., 122° 15′ W.

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Government Publications On Aeronautics

Army Air Service and War Department

IN accordance with the policy of providing the readers of *Aerial Age* access to official American literature on Aeronautics, there is printed following a series of lists of documents available for reference in Public Libraries, the Army Air Service Library and in some cases by purchase from the Superintendent of Public Documents, Washington, D. C. Many of these were issued for official purposes during the war but are now possible of study by anyone interested.

Two lists of the publications of the National Advisory Committee for Aeronautics have previously been published, in the November and December numbers.

The lists first above mentioned are divided as follows:

Air Service Information Circulars (aviation)
Air Service Information Circulars (Aerostation)
War Department Documents (relating to Aeronautics)
Air Service Miscellaneous Publications
Air Service Letters of Instruction
"U" Stencils

Primarily intended for official use and consequently issued in only a limited edition, many of these are out of print and only available for reference purposes. Correspondence in connection with these circulars should be addressed to the Chief of Air Service, Munitions Building, Washington, D. C.

One hundred Circulars constitute a volume, the last Circular of each series of a hundred being an index to the preceding 99.

VOL. I.

No.
1. Announcement of The Circular.
2. Report on First Transcontinental Reliability and Endurance Test
3. Air Medical Service
4. The Air Medical Service and the Flight Surgeon
5. Hispano-Suiza Engine, Model E & I, Ignition Timing Instructions and Chart (Dixie Type 800 Magneto)
6. Tentative List of Decorations Awarded U. S. Army Air Service, Am. E. F.
7. Enemy Aircraft Destroyed by U. S. Army Air Service
8. Destructive Whirling Test of "Micarta" Propeller and Rubber Covered Propellers with Hard and Soft Rubber Leading Edges
9. Test of Monel Metal Valves in Liberty Single Cylinder Engine.
10. Present Procedure in Static Testing of Airplane Engineering Division, U. S. Air Service
13. Tests of Various Types of Gasoline Hose Connections
16. Time Study of the Movement of the Firing Mechanism of the 37 m. m. Automatic Baldwin Cannon
17. Comparative Merits of Dixie Magnetos and Delco Battery Ignition System when used on Liberty "12" Aero Engine
18. Test of the Alsop-All-Spark Ignition Device and Measurement of Distances
19. Report of Test of French 37 m.m. High Explosive Ammunition
21. Aeronautical Book and Magazine List (out of print)
23. Report of Static Test on DH-4 (Dayton-Wright) Tail Surfaces
24. Report on Tests of Modified Firing Mechanism for the Baldwin 37 m. m. Cannon
25. Report of Static Test of Wing Cellule of Pomilio PVL-8 with Unequal Loads on Right and Left Wings.
27. Methods of Correcting the Longitudinal Balance of JN-6H Airplanes
28. Vibration Characteristics of the 300 H. P. Hispano-Suiza Engine
29. Report of Static Test of Fokker Type D-VII Chassis
31. Rate of Climb Indicators—Description and Theory (FOR OFFICIAL USE ONLY)
32. Report on Test of 37 m.m. Automatic Cannon on Cannon Engine.
33. Report on Wind Tunnel Test of Laddon Night Pursuit Airplane
34. Report of Static Test of the Fuselage of the D.H.4 (Dayton-Wright)
35. Comparative Test of Special Homogeneous Gasoline and Commercial Aeronautic Gasoline.
36. Report of Static Test of DH-4 (P-34) Wing Cellule
38. Report of Static Test of the Landing Chassis of DH-4 (P-34)
39. Structural Weight Analysis of Airplanes
41. Standard Engine Report on the Six-cylinder Benz Aviation Engine Rated at 200 H. P. at 1400 R. P. M.
42. Power Required to Drive Aeronautic Engine Magnetos and Generators
43. Report on Wind Tunnel Test of Messenger Airplane
44. General Descriptive Matter on Dopes and Instructions for the Application of Dope and Pigmented Protective Coverings.
45. General Descriptive Matter on Airplane Fabrics, Tapes and Cords, and Instructions for the Application of Fabrics to the Wings.
46. Aviation Gasoline—Specifications and Methods for Testing
47. Universal Test Engine
48. Storage and Preservation of Rubber Goods, Tires and Tubes—Liberty Ignition System Instruction Board
49. Report of Wind Tunnel Test on U. S. A. Aerofoils, 25, 26, 27, 28, 29.
52. Discussion of Stress Analysis of an Airplane with Cellule of the Multi-spar type of Wing Construction with Special Reference to the Loading Condition of the Standard Static Test
53. Properties of Woods at 10 per cent Moisture
59. Test Report of Marlin (7MG) Model 1916, after changes were made in Top Lock Container to Accommodate Single Shot Mechanism to be Used with Nelson Gun Control.
64. Standard Report on the 300 H. P. Hispano-Suiza Aviation Engine with Steel Cylinders
68. An Empirical Theoretical Method of Comparative Prediction of Airplane Performance
69. Air Service Reserve Officers—Officers who have accepted Commission in Aviation Section, Signal Officers Reserve Corps.
71. Performance Test of Fokker D-VII with Liberty-Six Engine
72. Notes on the Characteristics, Limitations, and Employment of the Air Service
73. Air Tactics
75. Tactical History of Corps Observation Air Service, A. E. F.
76. Notes on Recent Operations—General Principles—Corps and Army Observation—Pursuit—Day Bombardment—Balloons
77. Meteorology and Aeronautics—Location and Layout of Flying Fields Exploration of Upper Air—Forecasts—Light Charts—Magnetic Charts.
96. Manual of Aerial Photography (Provisional)
97. Official Airplane Report Form
99. Air Medical Service.

VOL. II.

102. A Method for Determining the Angular Setting of a Tail Plane to Give Balance at any Given Condition.
104. Report of Test on Steel Tubing and Wing Beams Taken from the Fokker D-VII
105. Covering Wing Gasoline Tanks in Martin Bomber
111. Comparative Test of Auxiliary Starting Devices for the Liberty Engine
115. Methods in Observation Practiced with Fifth Corps First American Army on the Fronts
117. Preliminary Choice of a Wing Section
118. Lubricating Oils—Specifications and Method for Testing.
119. Catalogue of Motion Picture Films and Lantern Slides
120. Observation, Selection, and Assignment.
126. Starting Torque on Liberty-Hispano-Suiza, and other Aviation Engines
127. Standard Engine Report of Hall-Scott, Type L-6, Rated at 200 H. P. at 1700 R. P. M.
128. Report on XBIA Cooling System Tests with 1,875 R. P. M. Propeller and 140 Sq. Ft. Radiator.
132. Performance Test of Roland D-VIB with 200 H. P. Benz Engine
138. Power Plant Laboratory Calibration of Six-cylinder 185-H. P. B. M. W. German Aviation Engine Prior to Test in the Altitude Chamber of the Bureau of Standards
143. Report on Performance and Design of Five Representative General Aviation Engines.
144. Report on Cooling System Test of Ordnance Model D with 300 H. P. Hispano-Suiza Engine and Nose Radiator at 168 Sq. Ft.
147. The Shift of the Angle of no lift on Propeller Airfoils.
148. Visualization of Air Flow.
150. Design and Stress Analysis of Wings for P. W. 2 Night Pursuit Type
151. Report on the Delco Automatic Generator Cut-out

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152. Design of Standard Lugs
153. Performance Estimate of Spad 16-A with 236 H. P. Lorraine Deitrich Engine
154. Report on Special Airplane Wheel and Tire
158. Test of Stromberg Inverted Carburetor Model NA-L5 on the 12-cylinder Liberty Aviation Engine.
169. Efficiency of McCook Field Wind Tunnel
172. Structural Design of Cabane Struts for the PW-1 with R.A.F. 15 Tapered Wings.
173. Performance Test of Junker SL-6 with 185 H.P. B.M.W. Engine
175. Instructions for Installing 85-A Mixture Control in Zenith US-52 Carburetors
178. Report Giving Tables Showing the Freezing Points and Specific Gravity of Alcohol-Water Mixtures.
179. Report of Wind Tunnel Test of the Effect of Rake Angle on Suction in Exhaust Stubs.
180. Final Report Chief of Air Service, A.E.F. to Commander-in-Chief, Am. E.F.
181. Legal Questions Affecting Federal Control of the Air.
182. Report on Test of Sample of Crystal-on and Preliminary Report on Non-fog giving Treatment of Glass, Using Crystal-on, by the Navy Department.
183. Airplane Performance and Design Charts
184. The Use of Aerial Photographs in Topographic Mapping.
189. Test Report of Kellogg 600 Watt Reverse Current Relay
190. Test of Odier Portable Engine Starter
195. An Analysis of the Effect of Supercharging
196. Description of the McCook Field Wind Tunnel
197. Airfoil Data on American and British Airfoils
198. Report of Wind Tunnel Test on U. S.A. 27 Airfoil
199. Test of Standard Liberty Cylinder Mounted on a Universal Engine Crankcase

VOL. III.

201. Investigation of effect of zinc Plating on the Physical Properties of Streamline Wire
202. Velocity Determination in McCook Field Wind Tunnel
203. Report on Investigation of Dip Brazing with 80-20 Brass
206. Cooling System Flight Test of Loening M-8
210. Notes on Airplane Flight Endurance (1)
212. Experimental Reinforced Plywood Truss Ribs
213. Deflection of Beams of Non-Uniform Section
214. Operating Tests of Magnetically Operated Starting Switches
216. The use of Commercial Low Test Automobile Gasoline in Aviation Engines.
217. Experiments on the Design of Intake Bell for a Wind Tunnel.
223. Induction System Pressures in Liberty Twelve and 300 H. P. Hispano-Suiza Aeronautical Engines
224. Report of Wind Tunnel Test of U. S.A. 27-A, B, and C Airfoils
225. PW-1, U.S.A. 27 Wings
227. Operating Liberty "12" and Wright-Hispano 300 H.P. Engines on Automobile Gasoline—Types of Standard Service and Training Propellers
228. Report of Static Test of Wing Structure of U. S. GAX-1 (Type VI)
229. A Treatise on Radio Mechanics.
230. Investigation of Junker Biplane Wings
231. Report of the Medical Research Laboratory and School for Flight Surgeons for the Calendar Year, 1920.
232. Test of Airplane Engine Heater
233. Report of Cooling System Flight Test of the Fokker D-VII with Mercedes Engine.
236. Oxygen supply for Altitude Flights
237. Air Medical Service
240. Investigation of the Effect of Routing Wing Beams on Modulus of Rupture and other Strength Properties (FOR OFFICIAL USE ONLY)
243. Calibration of Carburetor Jet Flow.
244. Report of Wind Tunnel Test on U. S. A. Airfoils 30,31,32,33 and 34
248. Report of Wind Tunnel Test on R. A.F. 19, Springer No. 3, and Gottingen No. 244.
249. Report on Standard Test of the A. C. Spark Plugs.
252. Standard Engine Report on ABC "Dragonfly" Aviation Engine Rated at 320 H. P. at 1650 R. P. M.
254. Report of Static Test on the J. V. Martin Shock Absorbing Wheels with the Curtiss JN-4 Chassis.
256. Instructions for the Storage of Airplanes, Engines, Their Parts and Accessories
257. Instructions to Pilots for the Use of Mixture Controls.
259. Investigation of Crushing Strength of Spruce at Varying Angles of Grain.
260. The Economic Limit in Aspect Ratio of Single Bay Pursuit Biplanes
262. Tip-Vortices shown by the McCook Field Wing Tunnel.
263. Investigation of the effect of the Ratio of Diameter to Gage Thickness upon the Torsional Strength of Steel Tubing.
267. Report of Wind Tunnel Test on Gottingen No. 277 Aerofoil.
268. Supplementary Report on Experimental Reinforced Plywood Truss Ribs.
270. Report of Static Test on Engineering Division Messenger Airplane.
271. Report on Cooling System flight test of DH-4-C as furnished by the Packard Motor Car Company.
275. Investigation of methods of making Manganese Bronze Castings to meet Air Service Specification No. 11021.
276. Tests on Combined Loading of Wooden Struts.
277. Laboratory Test on Hartmann & Braun Electric Thermometer.
278. Report on Special Airplane Wheel and Tire (28 by 4 Straightside Tire, One-piece Rim).
280. Performance Test of Messenger Airplane Equipped with 3-Cylinder 60 H. P. Lawrence Engine.
281. The Sylphon Fuel Pump for Liberty "12" and Wright Model "H" Engines.
282. Fifty-Hour Endurance Flight Test of Delco Automatic Generator Cut-Out.
285. Performance Test of Morane Saulnier Type A. R. Airplane with two sets of Wings Equipped with 80 H. P. LeRhone Engine.
286. Performance Test of Spad 13 Equipped with 220 H. P. Wright Engine.
287. Performance Test of DH-4 with Liberty "12", 400 H. P. Liberty Engine Equipped as Two Seater Corps Observation Airplane.
288. Official Performance Test of Fokker Monoplane D-VIII Equipped with 180 H. P. Oberursel Engine.
289. Comparative Effect of Engine Operation in Flight of Outside and Inside Air Intakes.
290. Official Performance Test of Martin Bomber N. B. S. 1 Equipped with two 400 H. P. Liberty 12 Engines.
291. Instructions to Designers of Aircraft Carburetors.
292. Report on the Control of Carburetor Metering Characteristics by the Supplementary Admission of Air.
293. Comparative Flight Performance of Liberty Engines Equipped with 5.42 and 6.5 Compression Ratios.
294. Cooling System Test of the Curtiss JN-4 with Packard 1A-744 Engine Equipped with Side Radiators.
295. Report of Cause of Cracking of Alloy Steels During Dip Brazing.
297. Investigation of Dip Brazing with High Melting Point Brass.
298. Investigation of Some Solder for Aluminum—Part 1.
299. Cooling System Test of LePere P-70 Equipped with Side Radiators.

VOL. IV.

302. Fifty-Hour Endurance Flight Test of Auxiliary Starting Device (Buzzer Starter) for the Liberty Engine.
303. Discussion of Airplanes Tires and Wheels
304. Nomographic Column Charts.
308. Investigation of the Effect of Doped Fuels on Fuel System
311. The Determination of a Carburetor Setting for the Liberty Engine for Dirigible use.
312. Design of large Trussed Ribs
313. Reinforced Plywood Web Spars.
315. Determination of the Best Wing Loading for Single Seater Pursuit Airplanes.
317. Method for Estimating Power and Fuel Consumption of Normal Compression Aviation Engines in Flight at Various Altitudes.
318. Effect on Variation in Load Factor on Structural Weight of Wings.
320. Determination of Water in Gasoline as Received.
322. Report of Static Test of Ski for an SE-5 Airplane.
328. Report on Wing Tunnel Test on Aerofoils.
332. Study of Stress Analysis of the JL-6
334. Report on Wind Tunnel Test of USA-27-C Modified Aerofoil.
335. Investigation of Forged and Cast Brass
336. Effect of Fuel Head at Carburetor, on Brake Horsepower and Brake Specific Fuel Consumption.
337. The economical Use of Duralumin as a Substitute for steel in Compression.
339. Temperature Effect of Capillaries of Liquid and Vapor Pressure Thermometers.
*340. Statistics Compiled from Reports on Crashes in the U. S. Army Air Service During the Calendar Years 1918 to 1921, Inclusive, and

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Results of Physical Examination for Flying During the Calendar Year 1920 and 1921.

341. Description of McCook Field Five Foot Wind Tunnel.

345. Report on Blower used in Tests of Air Cooled Cylinders.

346. Fuel Consumption Test of DH-4B with Liberty "12" Engine. Type XV Equipped with Wright Model "E" Engine.

353. Reserve Bending Strength of Struts.

354. Variation in Performance of a Hispano-Suiza (Model E) Engine with Degree of Throttle Opening.

355. Report on Wind Tunnel Test of DH-4B Model.

356. Variation in Volumetric Efficiency of Engine with Valve Lift.

357. Report on Test of Bijur Ignition End Starter for Airplane Engines.

360. Report of Static Test of the Junker L-6 Monoplane.

363. Heat Treatment Bath Composed of Sodium Chloride, Sodium Carbonate, and Sodium Cyanide.

364. Adaptability of the Hyde Welding Process to Steel Engine Cylinder Construction.

367. Wind Tunnel Test of the Junker L-6 Monoplane.

368. Tests of Back Suction and Air Bleed Type Mixture Controls in Flight.

369. The Bellows (Sylphon) Fuel Pump for Liberty 12 and Wright Model H. Engines.

370. Test of a Zenith Carburetor, Model U.S. 52, Fitted with "Plain Tube" and Britton Type Discharge Nozzle.

372. Flight Test of Anti-Knock Injector.

373. Test of Curtiss Eight Cylinder Model OX-5 Engine Rated at 90 H. P. at 1400 Revolutions per minute.

374. Interior Corrosion of Steel Struts and its Prevention.

*For sale at 5c a copy by Superintendent of Public Documents, Washington, D. C.

Certain of the following documents are available by purchase from the Superintendent of Public Documents, Washington, D. C., at the price indicated. Remittances should be made to him by money order, coupon, express order or New York Draft. These are marked with an asterisk (*).

Number	Title	Price
959	Aerial Gunnery Practice at Depot and Service Schools, 1918	
960	Aerial Gunnery for Depot and Service Bombardment and Observation Squadron 1919	
827	Aerial Observation for Artillery, 1918	
733	Aerial Observation in Liaison with Artillery Addendum to Instructions for Use of (1917)	
740	Aerial Observation in Liaison with Artillery, Instructions for Use of (1917)	
664	Aerial Photography, 1917	
714	Aerial Photography Department in the Field, Bulletin of, 1917	
955	Aerial Sights and Sighting, 1919	
843	Aeroplane Flare, Mark 1; and Release Mechanism, for Aeroplanes, 1918	
*935	Airplane Engine Carburetors, 1919	$.05
*998	Airplane Propeller, The, 1920	.45
966	Airplane Wire work, 1919	
913	Air Pressure, Gasoline Pressure and Oil Pressure Gages for Airplane Engines, 1919	
985	Airship and Balloon Gas Manual, Book I, 1919	.25
985	Airship and Balloon Gas Manual, Book II, 1919	.05
918	Air-Speed Meters for Aerial Navigation, 1919	
917	Altimeters for Aerial Navigation, 1919	
575	Anti-Air Craft Guns, Notes On, 1917	
*989	Anti-Air Craft Material	.20
*1004	Aviation Medicine in the A. E. F., 1920	.40
742	Barlow Heavy Drop Bomb and Release Mechanism Handbook, 1918	
597	Battle Maps, Instructions Concerning, 1917	
598	Battle Maps, Instructions Concerning; Annexes, 1917	
*986	Bomb Release Mechanism, Mark X, Service Handbook	
741	Bomb Sight, Mark I; Description & Instructions, 1918	
838	Bomb Sight, Mark I-A, 1918	
845	Browning Automatic Rifle, Model 1918—Handbook	
957	Camera Gun for Training in Aerial Gunnery, 1919	
991	Chanard Incendiary Bomb Service Handbook, 1919	
919	Clocks for Aerial Navigation, 1919	
*921	Compasses for Aerial Navigation, 1919	.10
418	Conventional Signs—U. S. Army, Maps 1918	
697	Co-operation Between Aircraft and Artillery During Recent Operations on 2nd Army Front, Notes on (1917)	
815	Corrector for the Anti-Aircraft Firing of Infantry Machine Guns, Provisional Instructions and Complementary Lecture on Organization and Use of, 1918	
*938	Curtiss Motor, The, 1919	.10
993	Demolition Drop Bomb, Mark I, 1920	
994	Demolition Drop Bomb, Mark III, 1920	
753	Drill Regulations for the 3" Anti-aircraft Gun, 1918	
717	Drop Bomb, Dummy, Mark I, Description and Instructions for Use of, 1917	
933	Electricity and Magnetism, 1919	
1046	Fabrics for U. S. Army Observation Balloons, 1920	
675	Field Service Manual for Ballon Companies, 1917	
634	Fire on Aeroplanes, Notes on, 1917	
840	Fragmentation Drop Bomb Mark II-A, 1919	
977	Fragmentation Drop Bomb Mark II-B, 1919	
*930	Gasoline Engines, 1919	.10
914	Gasoline Level Gage for Airplane Engines, 1919	
*965	General Information on Aerial Gunnery, 1919	.05
980	Hand Sewing of Material for the Covering of Airplane Surfaces, 1919	
724	High Capacity Drop Bombs, Mark I, II and III, 1917	
*942	Hispano-Suiza Motor, The	.15
777	Incendiary Drop Bombs, Mark I and II, Handbook, 1918	
920	Inclinometers for Aerial Navigation, 1919	
694	Identification of Aeroplanes, Notes on, 1917	
768	Infantry Aeroplane and the Infantry Balloon, The, 1917	
982	Information for Air Service Mechanics, 1919	
624	Information, Instructions on the Research and Study of 1917	
*936	Installation and Cranking of Airplane Engines	.10
664	Interpretation of Aeroplane Photographs, Notes on, 1917	
645	Landscape Sketching, 1917	
830	Liaison for All Arms, 1918	
639	Liaison in Battle, The Technique of, 1917	
625	Liaison Instructions for All Arms, 1917	
*941	Liberty Motor, The, 1919	.15
700	Listening Apparatus for Aircraft, Note On, 1917	
*931	Lubrication for Airplane Engines, 1919	.05
723	Machine Gun Drill Regulations, Provisional (1917)	
981	Machine Sewing for Air Service Mechanics, 1919	
*934	Magnetos for Gasoline Engines, 1919	
881	Manual for Balloon Cutters, 1918	
666	Means of Communication between Aeroplanes and the Ground, 1917	
706	Meteorology, 1917	
*945	New Types of American Motors, 1919	.05
*946	New Types of Foreign Motors, 1919	.10
924	Oxygen Control Regulator for Airplanes, 1919	
*954	Parachute Manual for Balloons, 1919	.10
923	Performance Testing Instruments for Airplanes, 1919	
961	Pilots' School Ground Training for Aerial Gunnery, 1919	
*939	Principal Parts of Airplane Engines, 1919	.05
816	Provisional Drill Regulations. Anti-Aircraft 75 mm. Gun, Model 1915, 1918	
*615	Provisional Machine Gun Firing Manual, 1917	.35
915	Radiator Thermometer for Airplane Engines	
630	Recent Operations. Notes on, 1917	
*925	Repair and Calibration of Airplane Instruments	.05
624	Research and Study of Information, Instructions on, 1917	
*944	Rotary Motors	.15
500	Signal Book, U. S. Army, 1916	
704	Sound Liaison, 1917	
839	Smoke Torch, Mark I—Description and Instructions for Use of, 1918	
963	Spad Mechanical Timing Gear for Aerial Fire Control, 1919	

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AERIAL AGE

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VOL. XVI May, 1923 No. 5

THE National Aeronautic Association of the U. S. A. has recently announced in the public press that the Association has decided to call an International Conference of scientists, technical men and aircraft manufacturers for the purpose of reaching a better international understanding in the matter of research work and the engineering end of aeronautics which, in the opinion of the Association, is most essential to the future progress of aeronautics. Also it is the announced intention of the Association to raise the question of Standardization and to promote a spirit of cordial coöperation in the progress of aeronautics among scientists, technical men and manufacturers both in the United States and in Europe.

We are more than pleased, we are proud of this announcement made by the National Aeronautic Association of the U. S. A. because AERIAL AGE has been the first aeronautical magazine in the world that has raised the point and during the last three years has conducted an active campaign in favor of Standardization and international coöperation in aeronautics.

The appointment of William Knight, associate editor of AERIAL AGE to Vice-Chairman of the Committees on Foreign, Industrial Relations and Scientific Research of the National Aeronautic Association and the announcement by the Association that our colleague will be actively in charge of the arrangements for the International Congress is a guaranty of the sincere efforts that the Association will make in order to obtain the desired results.

We wish to pledge once more our individual support to the splendid work that the National Aeronautic Association of the U. S. A. is doing and we are glad to see it take a bold stand on the matter of International Coöperation in Aeronuatics which is absolutely essential to the progress of commercial aviation.

We want to see America first in the air but we also want to see America be the first nation to recognize that aeronautics is primarily the carrier of the commerce of the world and that the basis of International Commerce is arrived at through international agreements between nations on all matter of common interest. International coöperation in aeronautics is a first step, and a long one, in the right path.

THE matter of the physical requirements that must be possessed by pilots before they are considered fit to fly was recognized as early as 1919 to be one that must be settled through international conferences and agreements. In fact it was recommended by the medical commission attached to the Peace Conference that an International Medical Congress be held at Oxford in 1920 in order to reach an international agreement on the matter of licensing pilots in so far as their physical ability to fly is concerned.

The Oxford congress did not take place in 1920. In 1921 at the first International Congress of Aerial Navigation this point was discussed once more but nothing was done because it was expected that the Oxford Congress recommended by the Peace Conference would take place in 1922.

We are now in 1923 and nothing has been done yet, in spite of the fact that everybody recognizes the fact that it would be absurd to have different medical standards adopted by various nations in this matter which would make possible for a pilot who is considered physically fit to fly in the United States or in England to be considered physically unfit to fly in Canada or France.

The matter of physical ability or disability of pilots to fly, especially in so far as their eyes and ears are concerned, and the criticism which must be adopted for judging about this are of the greatest importance both from the point of view of the safety of passengers and from the point of view of insurance companies.

The general impression in Europe, as it was evident at the first International Congress of aerial navigation in Paris was that in this country we are inclined to give less importance to this matter than is the case in Europe. We were not represented at that congress and we could not be heard.

It seems to us that it would be very detrimental to our own interests if we should fail to coöperate with other nations in this matter and we believe that the sooner we start realizing that aeronautics has international problems in which we are directly and most vitally interested, the better it will be for us in the long run.

A DICTIONARY of aeronautical terms in four or five languages is one of the most needed books in an aeronautical library now-a-days. A number of small size dictionaries serving more or less incompletely the present needs of a student of aeronautics who wishes to follow what is being published in the aeronautical press outside his own country were developed during the war by the technical services of the allied nations. More work in this direction has been done by the National Advisory Committee for Aeronautics in this country and by the Royal Aeronautical Society in London which have both issued much needed standard definitions of aeronautical terms used in the English language. A good dictionary giving the name of the same thing in English, French, German, Italian and Spanish, however does not exist at the present time and would be a mighty usefnl book to edit.

Could not this book be edited by either the National Advisory Committee for Aeronautics, who already has a large amount of material on hand for such a book, or else by the National Aeronautic Association of the U. S. A? The coöperation of governmental services and aircraft manufacturers of all nations to the successful edition of a really good aeronautical dictionary could not fail and such a book would be of a very great help to the development of aeronuatical knowledge.

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IN FRANCE the organization of aeronautical services for the transportation of sick and wounded through the air in flying ambulances has been greatly developed and perfected during the past year, especially as in the French Colonies where this method of rapid transportation has been of great help in checking the spreading of contagious diseases and in saving a good many lives of French soldiers and natives which would have been otherwise lost.

We have not done much in this country for properly organizing this service in connection with the work of our Red Cross and our sanitary corps. The money would be better spent in military aviation than in perfecting and developing the design and the use of aerial ambulances which could render valuable services in time of peace (especially so in some sections of the country which are not thickly populated), and which in time of war would be an almost invaluable means of saving some precious lives.

If our Red Cross and the American Relief Commission in Russia had been equipped with aircraft, the usefulness of the splendid work performed by them would have been greatly increased.

It is time, we believe, that we start using aircraft as a means for saving lives after the extensive use that we have made of them in destroying lives.

IT IS generally agreed by everybody that the success of flying is closely related to a successful establishment of meteorological services which will supply enough information to the flying fields to enable them to give proper instruction and information to pilots before leaving the aerodrome.

This is essential but there is something now that we must consider in connection with the laws and regulations that will be adopted for licensing pilots. A pilot must not only be able to carry out the instructions that he received before leaving the ground regarding the kind of weather that he will find along the route, he must also have a sufficient elementary knowledge of meteorology to enable him to recognize atmospheric conditions arising during the flight which were not anticipated at the time when he left the aerodrome and know in time what to do.

It will not be necessary to require from pilots an expert knowledge of meteorology but a light baggage of knowledge in this most important phase of aeronautics will not be out of place on a commercial craft where the lives of passengers and the security of valuable property is mostly in the hands of the pilot.

Official photo U. S. Navy

Airscaps of Graot Memorial, Washington, D. C.

Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U. S. A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D. C.

The National Aeronautic Association of U. S. A. assumes responsibility for the statements under this heading

THERE seems to be some misunderstanding throughout the country in regard to the connection between the National Aeronautic Association of U. S. A. and the Federation Aeronautique Internationale, with respect to the authentication of records by the Contest Committee of the National Aeronautic Association covering record performances in the United States.

The Press of the country sent out statements concerning the recent attempt by the Army Air Service to secure the world's record in aeronautical performance at Dayton, printing therein that French officials were at Dayton to time the contestants and that the F. A. I. was in control, together with other misleading statements, ignoring the N. A. A. altogether.

The truth of the matter is contained in the following:

"The National Aeronautic Association of U. S. A. is now the sole American representative of the Federation Aeronautique Internationale, and in the future, all contests, flights for records, sports and meets in this country, in order to be homologated for purposes of world's records, must be under the rules and regulations of the Association by virtue of its affiliation with the F. A. I.

"Under the F. A. I., the Association appoints committees responsible for the enforcement of the rules of the Federation, issues licenses to pilots, and for meets and races; sanctions meets, races and sports; classifies aircraft; examines and passes upon regulations and programs for contests; ratifies results; may bar suspended persons from participating in events; passes upon the advisibility of events; designates approval of officials and appoints timekeepers; gives official ratification to records and imposes penalities; pronounces the homologation of international events, and gives final decisions as to international records."

Confirming the above, Colonel Frank P. Lahm, Chairman of the Contest Committee of the N. A. A. has sent to the Press Associations and the Editors of the newspapers throughout the country the following communication:

"The National Aeronautic Association of the U. S. A. is the American member and sole representative in the United States of the confederation of world aeronautical bodies—the Federation Aeronautique Internationale, whose headquarters is in Paris, France.

"As sole representative the National Aeronautic Association of U. S. A. with headquarters in Washington, D. C. sanctions all official aeronautical race events in this country. Its Contest Committee appoints all official starters, timers and observers.

"No officials from France or any other country of the Federation Aeronautique Internationale officiate at any race meet in the United States. The F. A. I. statutes are observed to the letter at all sanctioned American contests.

"The authentication of a record by the Contest Committee of the National Aeronautic Association of U. S. A. is accepted by all clubs and federations affiliated with the F. A. I. as final".

At Dayton, in control of the speed trials at Wilbur Wright Field, now being carried out by the Army Air Service, the officials appointed by the N. A. A. are all Americans and are as follows:

Chief Timer: Mr. Odis A. Porter, Stand No. 1

Ass't Timer: Mr. L. Luzern Custer, Stand No. 2.

Directing Official: Mr. Orville Wright of the Contest Committee of the National Aeronautic Association as Official Observer at Station No. 1.

Mr. Lorin Wright of the Contest Committee of the National Aeronautic Association as Assistant Official Observer at Station No. 2.

Mr. Charles M. Kelso: acted as observer at the 500-meter point before station No. 1.

Mr. George B. Smith: acted as observer at the 500-meter point before station No. 2.

These officials were in charge of the flights of Lieut. R. A. Maughan and Lieut. L. B. Maitland, when Maitland broke the world's record for one kilometer course, establishing an average speed of 239.95 miles per hour.

It is hoped that this explanation will be sufficient to set at rest for all time the question of who is the authority in this country for authenticating official records of aeronautical performance.

The N. A. A.'s Membership Campaign. The membership campaign now being conducted by the Association is in full swing and progressing most satisfactorily. There is an awakening throughout the entire country to the fact that the Association's motto "America First in the Air" is a serious mark to which Americans must try to attain. In consequence of this the membership campaign is rolling up impetus which beyond question, will exceed the mark set for June first, 50,000 members. Reports from the field indicate that the membership will probably reach 100,000 by that time.

Below is a supplementary list of the officials of the Association and the District chairmen, a list which is being augmented daily.

FIRST DISTRICT

The District Chairman and treasurer is Col. Edgar S. Gorrell, President of the Boston Marmon Company. The Executive Secretary is Mr. Roger Merrill of Boston.

State Advisory Committees:

Maine: W. H. Gannett, Editor and Publisher, Chairman and Ralph Webber, Secretary, both of Augusta, Maine.

New Hampshire: Major Frank Knox, Chairman, and Guy L. Foster, Secretary, of Manchester, N. H.

Rhode Island: Governor Wm. S. Flynn, Chairman, Providence, R. I.

Vermont: Governor Proctor is Chairman of the Advisory Committee and Col. Ernest W. Gibson of Brattleboro is Chairman of the Campaign Committee. Mr. Frederick Harris of Brattleboro is to form a chapter there.

SECOND DISTRICT

The Executive Secretary is Mr. Evan J. David of the John Price Jones Corporation, New York City. The District Advisory Committee is made up of the following men: Howard S. Borden, Milton F. Davis, John D. Larkin, Charles E. Merrill and Palmer Pierce, all of New York.

THIRD DISTRICT

The Executive Secretary is Mr. R. P. Strine of Phila.

FOURTH DISTRICT

The District Chairman is Mr. Charles A. Moffett, President of the Gulf States Steel Company of Birmingham. The Executive Secretary is Mr. L. L. Boyer, of Birmingham.

Georgia: The Chairman of the State Membership Campaign Committee is Mr. L. W. Roberts, Jr., and the Vice Chairman Mr. J. E. Addicks, both of Atlanta.

Mississippi: The Chairman of the Advisory Committee is Governor Lee M. Russell of Jackson.

So. Carolina: The Chairman of the Advisory Committee is Governor McLeod of Columbia.

Tennessee: The Chairman of the Advisory Committee is Governor Peay.

FIFTH DISTRICT

The District Chairman is Hon. Newton D. Baker of Cleveland, Ohio, and the Executive Secretary is Mr. Carl B. Squier of Cleveland.

Ohio: The Chairman of the Membership Campaign Committee is Mr. Frederick B. Patterson of the National Cash Register Company with Mr. John Ahlers as Assistant. Mr. A. W. Henn is also on this Committee.

Indiana: Mr. F. E. Moskovics Vice President of the Marmon Company is the Chairman of the Membership Campaign Committee in Indianapolis.

SIXTH DISTRICT

The District Chairman is Mr. Samuel M. Felton, President of the Chicago and Great Western Railway, and Mr. Thomas L. Munger is the Executive Secretary. The Treasurer is Mr. Frank Whiting also of Chicago.

Michigan:

Detroit: The Membership Committee in Detroit is composed of the following men:—E. A. Loveley, Charles Bush, William F. Metgerm, Col. W. H. Alden, D. S. Stearns, S. W. Utley, George Holley, W. A. Mara, Col. J. G. Vincent and Col. Edgar Goodloe.

Bay City: The Chairman of the Membership Committee is Mr. L. P. Koepfgen.

Wisconsin: The Chairman of the Membership Committee at Milwaukee is Mr. Stephen J. McMahon, with Mr. F. A. Vaughn also on the Committee.

SEVENTH DISTRICT

The District Chairman is Mr. Joseph Pulitzer of St. Louis, Mo. and Mr. Roy B. Fisher is Executive Secretary from Davenport, Iowa.

Minnesota: Governor J. A. O. Preus of St. Paul is Chairman of the Advisory Committee.

Kansas: Governor Jonathan M. Davis

(Concluded on page 248)

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THE NEWS of THE MONTH

A Memorial to the Wright Brothers

Dayton, Ohio, the home town of the inventors of the airplane, is getting together a fund for the erection of a Wright Memorial, the proposed site of which is on the spot at Simms' Station where the first plane was built. This ground is also incorporated as part of the plot presented to the United States Government by Dayton citizens for use in building a new home for the Engineering Division of the Air Service. Should Congress accept this location the memorial will probably be constructed as an artistic bit of architecture near the entrance to the Government Station.

New York Chapter N. A. A. Organized

A New York chapter of the National Aeronautic Association of the United States was formed April 5 at a meeting in the Hotel Biltmore and Charles E. Lucke, a consulting engineer and Professor of Mechanical Engineering at Columbia University, was elected President. The purpose of the chapter is the development of commercial aviation and the creation of interest among the people of the country in aviation, so that America may be made first in the air.

Other officers elected were David W. Magowan, Vice President; Archibald Black, Secretary; G. Douglas Wardrop, Treasurer.

National Balloon Race at Indianapolis

Indianapolis has been awarded the national elimination balloon race in a keen contest with Detroit, Milwaukee and San Antonio, it was announced at headquarters of the National Aeronautic Association. The contest will be held between June 9, and July 4, and according to present arrangements, the motor speedway at Indianapolis will be utilized as a balloon field.

The entry of fourteen American balloons is assured, out of which the first, second and third in the race will be the American entries in the international balloon race at Brussels, Belgium, Sept. 23, for the James Gordon Bennett trophy. The American race will be held under the auspices of the National Aeronautic Association and the Aero Club of Indianapolis, assisted by the Indianapolis Chamber of Commerce which has guaranteed the expenditures in connection with the meet.

The Army and Navy will probably be represented by four entries and four new balloonists have filed entries with B. Russell Shaw, Executive Chairman of the contest Committee of the N. A. A. Some revolutionary ideas in balloons are promised by new entrants and there is indication that the elimination contest will provide sensational sport. Indianapolis will put up a purse of $3,000 for division among the contestants. Interests in future aerial competitions will be stimulated as a result of the membership campaign of the National Aeronautic Association, which has made provision for an annual fund of $75,000 for prize awards if the quota of 50,000 members is attained throughout the country. With favorable wind and weather at Indianapolis it is confidently expected that the American record of 1,172 miles for free balloon flight, held by Allan Hawley of New York, will be shattered.

Official starters, timers and observers for the elimination race will be appointed by the National Aeronautic Association, which must authenticate the records for acceptance by the Federation Aeronautique Internationale, of which the association is the sole representative in America.

Airport for Chicago

A municipal airdrome is at last an assured fact for the city of Chicago. During the season of 1922 negotiations were begun to secure such a field which would be open to all pilots both local and visitors. A tract of ground consisting of 80 acres (one half mile long and one quarter mile wide) was leased from the city. It was so late in the Autumn that nothing was done until recently toward putting the field in shape for landing.

At present a three ship tent hangar is being erected which was secured from the government and an underground gasoline tank and service pump have already been installed. By April 1st, there will be a small shop, culverts, driveways, stock room etc., in place ready to service visitors and local flyers.

This field is situated at the Southwest side of the city, on the Northwest corner of 63rd Street and Cicero Ave. It is about 25 minutes from the down town district by Auto and has street cars on both the South and East side which takes one to the city in 45 minutes. There are lunch rooms and other stores adjacent to the field where the visitor may eat and secure the necessary things he may want.

The field is sod and has drainage ditches on two sides which assures safe landings most of the season. Cinder runways will also be established as fast as possible. Also extra hangar space will be put up during the season. This field will be operated for anyone who wishes to use it and the army, navy and mail planes will not be charged for landing or storage.

Several of the local companies have indicated that they will use this field. The Diggins School, The James Levy Company, Chas. Patterson, and others. The two first named companies have affiliated this year and are entering upon their fifth year of operation. They will carry on instruction, passenger flights, photography, sales, cross country, and a general Aviation Business. This is without doubt one of the biggest affiliations in the industry in this section.

The National Airplane Meet

A unique aerial race, the first of its character staged, will pit a specially built dirigible balloon against an airplane at the national airplane race meet at St. Louis. The dirigible is designed to make a speed of eighty miles an hour and the contending airplane will be a JN-4, one of the most popular training machines used in this country. Aeronautical sharps are looking for a close race with something of a comedy element in it because of the "fat and lean" contrast between the two aircrafts. The event, however, is planned as a serious test of Army equipment to bring out features adaptable to the air defense of the country in time of war.

Led by Acting Mayor Aloe, the St. Louis airplane race committee with the cooperation of the St. Louis Flying Club, has all local business interests united in working together to

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make this the greatest meet in the history of aviation. It was announced at headquarters of the National Aeronautic Association today that manufacturers of aircraft and accessories are already offering special prizes for particular performances by the contestants and that the indications are for the greatest collection of awards for contenders ever known at an aviation exhibition.

St. Louis is making a special campaign to enroll every man and woman in the city in the National Aeronautic Association in order that the race meeting days, October 1, 2 and 3, which fall in the week of the annual carnival of the Veiled Prophet, with its great parades, ball and banquet, will add to the alluring attractions of that autumn festival. A plan is on foot to make an intensive canvass of St. Louis, beginning May 14, with leadership in numbers in the Association over every city in the country the goal.

Acting Mayor Aloe is moving every influence to present at the annual meeting of the National Aeronautic Association, which will bring hundreds of the leaders in American aeronautics together during the race meet, a solid phalanx of members as the largest reception committee on record. The appeal to St. Louisans to pledge themselves to membership during the country-wide campaign of the Association that aims at a mark of 50,000, is three fold, and the acting Mayor is said to be confident that his city will do the unexpected at the race meet, the carnival and the convention. Governor Hyde of Missouri, who has under consideration accepting the chairmanship of his State's advisory committee of the National Aeronautic Association for the campaign, is expected to be present during the races and extend a welcome at the convention.

Missouri is keenly awake to the need of aeronautical advancement that will place unshakably "America first in the air." This is the slogan for the membership canvass which, enthusiastic workers in the field declare, is bound to result in bringing 100,000 into this patriotic movement by June 1. The extensive agricultural activities of Missouri are taking an active interest in the utility of aeronautics and there is a growing demand for aerial forest patrol, dusting and spraying of trees, the conservation of crops and scientific research which will enhance the products of Missouri soil.

As it is one of the principal functions of the National Aeronautic Association to inform the people of the attainments in the air that benefit commerce, finance and agriculture, the endorsement of its work in Missouri is already shown convincingly by the enthusiasm with which it greeted the award of the national airplane races to St. Louis in the keen competition with many other cities. All Missouri is a unit with every section of the country in the purpose to work within the National Association to maintain the economic leadership of the country and the national independence through a wise provision for the air defense of the United States and its possessions.

Official photograph U. S. Army Air Service

Oblique aerial photograph of the important official and business center of Washington. The Department of the Interior Building is in the right foreground; the State, War, and Navy Building behind it, and just peeking above the roof of this last building is the roof of the White House. The grand columns of the Treasury Building are beyond, blocking off the east boundary of the "Little Mall", centering on the White House at right angles to the Grand Mall between the Capitol and the Lincoln Memorial.

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THE AIRCRAFT TRADE REVIEW

New Loening Air Line

A group of prominent citizens of Newport have raised a subsidy for the operation of a fast and properly equipped Air Line, which has been awarded to the NEW YORK-NEWPORT AIR SERVICE, INC., a new company which has just been formed for this purpose.

This group includes many prominent men and women, among whom are Robert Goelet, Arthur Curtiss James, James B. Duke, Henry Walters, Oliver Gould Jennings, Henry A. C. Taylor, Stewart Duncan H. Barton Jacobs, Marion Eppley, George Henry Warren, Forsythe Wickes, Ogden Hammond, Clarence Dolan, James S. Cushman, Mrs. Vanderbilt, Mrs. Nathaniel Thayer, Mrs. O. H. P. Belmont, Mrs. Horace Gallatin, Mrs. James B. Haggin, Mrs. Charles F. Hoffman, Mrs. Hugh Auchincloss, Mrs. Frederick Tearson, Grafton Cushing, John Aspegren, J. F. A. Clark, Francis Roche, George Widener, I. Townsend Burden, Lawrence I. Gillespie, Clarence Pell, Oscar Cooper, Edson Bradley, William Fannestock, Condé Nast, Paul Fosdick, Bradford Norman, R. G. Shaw, T. Suffern Tailer and Vincent Astor.. Mr. T. Suffern Tailer and Mr. Astor were appointed a committee to develop this service.

The manner in which the subsidy raised by citizens of Newport has actually resulted in the organization of a new company with new equipment is typical of the manner in which subsidies have helped commercial aviation in Europe where the governments of France, England, Holland and Germany grant large sums of money outright to aircraft operators in order to enable them to meet the high expense of a properly maintained Air Service. While efforts have been made in Congress to point out the desirability of this policy for years and obtain some kind of legislature therefore, it has remained for a group of public spirited citizens on their own initiative to do it themselves.

The directors and incorporators of the new Air Line are Vincent Astor, Grover Loening, Edwin deT. Bechtel, Charles L. Lawrence, Roger M. Poor, Albert Palmer Loening, and John Carrington Yates, all of New York. The fast Loening Air Yacht, which holds several world's records, is the type of aeroplane that will be used. This is the same type as was used so extensively last Summer by Mr. Astor in his flying between New York and Newport and the North Shore, and also by Mr. Harold Vanderbilt. The machines to be used on this line represent the highest development of new commercial aircraft in America and the New York-Newport Air Service is the first Air Line in this country to use in its work brand new machines of the most modern design and having so high a speed that a real service in time saving is rendered. Heretofore, Air Line operators in this country have been more or less forced to use old war types of aeroplanes disposed of by the government at low prices. The new machines are very much faster and more efficient, so that the trip from New York to Newport may be made in an hour and a half, whereas it takes six hours by train.

The new Air Line is to use the same type of motor so successfully used by the trans-continental Air Mail Service and through the courtesy of the Post Office Department and Mr. J. E. Whitbeck, Superintendent of the Eastern Division of the Air Mail, the personnel and maintenance system on the motors and planes is being developed from and modeled after the vast experience of the Air Mail experts. Mr. Grover Loening, who will be in charge of the operating, has just returned from an extensive study of European Air Lines and flew over 2,000 miles on the various machines over there.The latest practices on the proper operation of air transportation will be applied on the New York-Newport Air Service and every possible safety precaution that has been developed to a successful and reliable point will, of course, be used.

Sikorsky Aero Corp. Organized

The Sikorsky Aero Engineering Corporation was chartered on March 5th, 1923, by the Secretary of the State of New York, with a capitalization of $200,000.

The purpose of the Corporation is to build, sell and in general exploit the aeroplanes of Mr. I. I. Sikorsky's system.

Mr. I. I. Sikorsky, who is President of the Corporation, is the famous Russian constructor of the first multi-motored aeroplane in the World, as well as the first successful large aeroplane. The other officers of the Corporation are:—

Mr. W. A. Bary, Treasurer, Mr. L. A. Shoumatoff, Secretary.

The offices of the Corporation are temporarily located at 114 East 25th Street, New York City.

Gallaudet Plant on Full Time

The Gallaudet Aircraft Corporation at East Greenwich, R. I., is now operating on full time, employing 215 hands.

U. S. Airport Facilities

The Aeronautical Chamber of Commerce with the able assistance of the federal air services computed the airports in this country, as follows:—Government 123; Commercial 184; Municipal 160; Seaplane 110; undeveloped facilities 1756—making a total of established and possible airports, 2,333.

Charles F. Redden, Charles S. Jones and Archibald Black have been appointed a committee on air terminal to advise and assist individuals, corporations and others in establishing land and water terminal facilities.

Italy to Subsidize Aircraft Industry

Dispatches from Rome indicate that Premier Mussolini's plans for establishing the air force on a firm foundation include the subsidizing of the industry and insuring a continuous output of planes and motors along with advanced engineering research. The air service has been made co-equal with the Army and Navy.

Barber & Baldwin, Inc.

Barber & Baldwin, Inc., have issued a very interesting booklet detailing their activities and the purposes for which the firm was organized. Their office is at 30 East 42nd Street, New York. Mr. Horatio Barber, senior member of the firm, will be remembered as the author of "The Airplane Speaks," and one who has been identified with aviation the last fourteen years. With Mr. Barber the directors include Robert H. Baldwin and J. Brookes Parker, assisted by Archibald Black, the aeronautical engineer. The firm is listed as aeronautical consultants, underwriters and fiscal agents.

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New Navy Air Engine Runs for 573 Hours

Completion of a record-breaking test of a new airplane engine was announced April 7 by the Navy Department. For 573 hours the power plant, known as a Wright model E-4, ran without a stop with the throttle wide open. Data accumulated during the run indicated "a saving of 90 per cent. in the operating cost of aircraft engines of this type."

An indication of the remarkable endurance of the new engine will be given, engineers said, by comparison with the types used in the World War, when 100 hours was considered a long run.

The engine was built by the Wright Aeronautical Corporation of Paterson, N. J. During the test it would have covered, at the usual cruising speed maintained by the navy at sea, approximately 60,000 miles, or two and a half times around the world at the equator, in a period of a little more than three weeks, according to Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics.

To give a further popular picture of the performance of the Wright E-4, Admiral Moffett compared its record to that of the average better grade high-power automobile, which, he said, usually traveled about 6,500 miles annually. At the rate theoretically flown by the new engine, it could have driven the automobile for approximately nine years at 100 miles an hour.

"The improvement is the result of intensive work for more than a year in the engineering section of the Bureau of Aeronautics," Admiral Moffett said, adding that a new standard had been set up, both in regard to operating cost and to dependability.

Army Aviators to Take Up Gliding

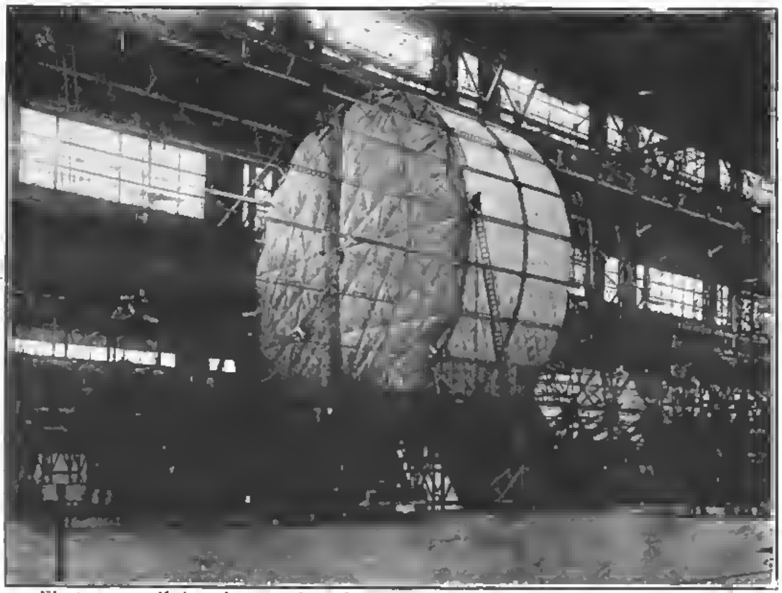
The Army Air Service will devote its attention for some time to come to the development of the glider, or motorless airplane. This was announced at the War Department where it was said the department had become convinced that the development of interest by civilians in the glider would prove invaluable to the Government in training men for service as emergency airplane pilots.

Several tests of the GL-2, a motorless airplane, have recently been conducted at McCook Field at Dayton, and the result of those experiments, it is stated, were most satisfactory. In one flight, the machine covered 150 feet, and in another it exceeded 300 feet. The wind velocity during the tests was two to fifteen miles an hour.

A recent ingenious development of the glider at McCook Field is its use as a target for the practice of anti-aircraft gunnery. The so-called "target glider," as developed by the Air Service Engineering Division, is a smaller edition of the regular glider and is fastened to the top wing of an airplane. On being released the target glider gradually descends to the ground at a speed of about thirty miles an hour, affording a realistic target for anti-aircraft and airplane guns.

The "target glider" has a wing span of twelve feet six inches, an area of eighteen square feet and weighs twenty-three pounds. This size was decided upon as presenting as much surface to the gunner as the vital spot of a full-sized airplane. The speed at which the glider descends may be regulated by change of weight or manipulation of tail surfaces. It can even be adjusted before release to loop or spiral.

The experiment, according to army officers, showed that up to speeds reached in the test flight, fluttering of the glider did not occur; that even when released with insufficient incidence it could be made to leave the airplane without danger of fouling; that a greater altitude was necessary in order to give it a chance to recover its normal glide; that the release latch was satisfactory, and that about five inches should be cut from the glider tail to assure sufficient incidence for a prompt get-away when released.



First gas cell in place and under test in the giant Navy rigid airships now being built at Lakehurst, N. J.
© Official photograph U. S. Navy

Building Dirigible to Carry 12 Planes

The giant semi-rigid airship now being constructed at Akron for the Army Air Service, is to be used as an airplane carrier. Plans are practically completed, it is stated, for equipping the great dirigible with twelve small fighting planes, which cannot only be picked up by the airship while both are in flight, but which also can "take off" from the moving airship.

Experiments just completed at Mitchell Field, Mineola, L. I., have proved incontrovertibly that airships

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can be used as airplane carriers, Air Service officials state. While the general type of apparatus for picking up the planes and for launching them has practically been determined, it is possible that further experimentation will result in slight modification of their apparatus.

In the experiments at Mineola, which till now have been kept secret, a large ring was placed on the upper wing of the airplane, and a hook of considerable size was suspended from the basket of the airship. After the airship was in full flight, the airplane pilot flew under the basket of the airship, regulating his speed to that of the dirigible. Since the equality of speed gave practically the same effect as if both machines were standing still, the picking up of the airplane was accomplished quite easily. No mishap of any character was experienced during the experiments, army fliers assert.

The great airship which will be used as an airplane carrier, is one of three contracted for by the War Department with the Goodyear Tire & Rubber Company. One of these, the TC-1, was recently completed, and is now undergoing trial flights, following which she will make a cross country flight to Niagara Falls and return.

Though the TC-1 is the largest semi-rigid airship ever built in America, she is scarcely one-third the size of the ship which will be used as a carrier. The TC-1 has an envelope capacity of 200,600 cubic feet, while the new ship will have a gas capacity of 750,000 cubic feet and will be the biggest semi-rigid in the world.

The new airship, which will probably be called the TC-2, will be completed about Sept. 1. In size she will be somewhat smaller than the ill-fated "Roma," which was burned at Hampton Roads, Va., more than a year ago with great loss of life. In lifting capacity, however, she will be superior to the Roma and, according to air officers, she will be much safer. The board of inquiry which investigated the Roma disaster found that the great loss of life was due primarily to the conflagration resulting from the ignition of the hydrogen gas which inflated the envelope. The new ship will be so constructed as to permit of inflation with helium, which is non-inflammable, and army experts assert advantage has also been taken by the engineers of the lessons learned from the Roma disaster in avoiding certain weaknesses of construction. The new ship also is expected to have greater speed and manoeuvering ability than the Roma.

The Army Air Service for more than a year has been studying the problem of utilizing airships as airplane carriers. As a matter of fact, it was the expectation that experiments along this line might be conducted that the army decided to purchase the Roma from the Italian Government. Tentative plans for such experiments already had been worked out and would doubtless have been put into effect but for the disaster to the "Roma."

Since that time still further study has been made of the problem and activities of other nations in this respect have been investigated with the result that plans are now practically complete.

Under the naval treaty adopted at the Washington arms conference, an absolute limitation is placed on the number and tonnage of naval airplane carriers which any of the signatory powers may have.

Two New Army Records

American airplane speed records for 500 kilometer (310 miles) and 1,000 kilometers (620 miles) were authenticated by the contest committee of the National Aeronautic Association April 7, both made by Army aviators. The 500 kilometer speed record was made by Lieut. Alex Pearson, flying a Verville-Sperry plane with Wright motor, who maintained a maximum speed of 167.8 miles an hour. This performance exceeded the world record of Boussoutrot of France, made last year, of 86 miles an hour by more than 81 miles, speed over the 310 mile course, also the mark made by Lieutenants Batelier and Carrier at Etampes, France, March 30, of 115 miles an hour by more than 52 miles.

The 1,000 kilometer record was set up at 127.42 miles an hour by Lieutenants H. R. Harris and R. Lockwood, flying a DH-4 plane with a Liberty motor, exceeding the French record of Boussoutrot and Bernhard of 61.68 miles an hour by more than 66 miles speed, and the mark of Batelier and Carrier made March 30 at Etampes, 93 miles, by more than 34 miles speed an hour.

The two record flights were made during trials of six Army airplanes over the measured course at McCook field, Dayton, Ohio, on March 29. Orville Wright was the official representative of the National Aeronautic Association, and Otis Porter of Indianapolis the official timer. These records have been filed with the Federation Aeronautique Internationale at Paris, which is solely represented in America by the National Aeronautic Association.

Radio Towers at Fairfield

The Army Air Service has completed two steel radio towers, 160 feet high and 475 feet apart at the Fairfield Air Intermediate Depot. These are to be illuminated at night.

The T-C-1 Successfully Tested

Uncle Sam's latest leviathan of the air, the United States Army training airship C-type-1, the largest non-rigid ship ever built in America began her trial flights March 16 at Goodyear Akron Air Station, under the supervision of a crew of officers and men from Scott Field, Belleville, Ill.

The T-C-1 as she is officially known, is the first of three ships of this type being built for the army by the Goodyear Tire and Rubber Co. of Akron, Ohio, and will be used as a training ship for airship pilots in preparation for several transcontinental flights contemplated by the senior service for this and other ships of this type.

In design and construction the new airship carries several features especially arranged for the use of helium gas, which will be the standard lifting power of this type.

Her envelope has a gas capacity of 200,600 cu. ft. and she is 195.81 ft. long.

The car suspended from the envelope is 40 feet long and contains accommodations for a crew of six men when helium is used. When hydrogen is used a crew of ten men can be carried.

Two Hispano Suiza motors of 150 horsepower each furnish the driving power. A speed of 60 miles per hour can be maintained with a range of 1070 miles. Slackening down to a speed of 47 miles per hour she will have a cruising range of 1,630 miles.

The T-C-1 is equipped with bomb carrying and releasing devices. One 1,200 lb. bomb, four 400 lbs., and eight 100 lbs. will be carried.

She also carries a complete radio installation of the latest type.

The crew which carried the T-C-1 through her preliminary tests was composed of: Lt. F. M. McKee, test and instruction pilot, Lt. C. Kunz, test pilot and engineering assembly officer, both of Scott Field, Belleville, Ill., Lt. J. Cluck, official observer and pilot of the Air Service, Washington, D. C., Sgt. Harry Barnes and Sgt. Olin Brown, motor specialist from Scott Field.

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AIRPLANES IN THE DEPARTMENT OF AGRICULTURE

GOVERNMENTAL use of aircraft is on the increase. The Geological Survey, Coast and Geodetic Survey, the Engineers, the Bureau of Mines, the Post Office, the Weather Bureau, and the Department of Agriculture are all making all possible use of the airplane.

With the production of proper types, with increased flying personnel, increased appropriations, further extensions of the application of aircraft of all types are to be looked for in the not too dim distant future.

The Department of Agriculture is again to scout by air in the campaign against the boll weevil.

During the Summers of 1918 and 1919 an airplane was used in certain sections of Texas to locate isolated cotton fields that might otherwise have escaped inspection and might possibly have been infested with the pink boll worm. This scouting work was successful. Secretary Wallace says so himself. But, it was discontinued because of an accident in which the plane was destroyed and both the pilot Lieut. Tillisch and the observer E. L. Diven, lost their lives. This scouting work was probably the first use of the airplane in agricultural work.

This experiment was made possible through the cooperation of the Army Air Service, which loaned Lieutenants Wm. H. Tillisch and Harold Compere, the first boll weevil pilots of record. The work was prosecuted for over a year with great success and was particularly valuable in the scouting necessary along the long stretches of the Rio Grande where roads or other means of transportation are poor or insufficient. Although these flights had been conducted over a long period without serious accident, the danger of the service was recognized and the greatest honor is due these men for remaining beyond their allotted time in the service because of interest in this new use of the airplane.

At Riverton, N. J., an airplane was used in October, 1919, by Lieut. Potter, in the photography of the area infested with the Japanese beetle.

Crop reporting is a probability. The airplane's ability was demonstrated on April 30, 1919, when Ohio field agent Col. J. L. Cochrun made a survey of the progress of spring plowing in Montgomery County, O., from an airplane. A fairly good conception of spring work was obtained, as well as the proportion of the total acreage that was under cultivation. This suggests the use of the camera in the making of these crop surveys, said the Monthly Crop Reporter of the Department of Agriculture.

The airplane proved more advantageous than the horse in the dusting of cotton with calcium arsenate. In August, 1922, the Department took up trials of the airplane, equipped with special hoppers and dusting apparatus, for fighting the cotton worm and the boll weevil in Northern Mississippi. The results showed a great deal of promise for this method. The dust is distributed very effectively over the field, the new method giving better results than horse-drawn dusters. The Department thinks enough of this that it is preparing a report on this work for puhlication.

The gypsy moth is not to be undisturbed. In June, 1922, a number of trial flights were made over two forest areas in New Hampshire near Alton and Hooksett where the gypsy moth had appeared in large numbers. However, in this instance the moth had a bit the best of the argument.

Dr. L. C. Howard, Bureau of Entomology, of the U. S. Department of Agriculture refers us to experiments in Canada in the location of insect damage to forests. He expresses the belief, through AERIAL AGE that planes might be of value in locating green fly damage to wheat. In winter wheat in Texas and Oklahoma the insect appears first in spots which it is important to recognize immediately. Such spots may be seen from above when they would not be noticed by a man on the ground.

Airplanes are not alone in their travels. Rust spores have taken to the airways. In an investigation of the extent to which rust spores were distributed by air currents, flights were made in the Summer of 1922 from fields at San Antonio, Tex.; Fort Crook, Omaha, Nebr.; Minneapolis, Minn. (in cooperation with the Minn. National Guard); Chanute Field, Rantoul, Ill.; McCook Field, Dayton, O.; and Camp Knox, Louisville, Ky., by airplanes of the Army Air Service. Spores of stem rust were found in the air at altitudes of from 1,000 to 10,000 feet. It is significant to the U. S. D. A. that the number of spores caught in the air decreases rather rapidly as the distance from rusted grains and grasses increases.

The Forest Service, in 1921, furnished another definite example of the Department's foresight in the application of aircraft to peacetime pursuits and the conservation of energy, time and expense. At an estimated cost of but $2524, including fuel, oil, pay, etc., a saving of $125,000 was effected in the estimate of the damage done by the hurricane on the Olympia Peninsula.

In 1922 the Forest Service used an airplane for searching out some uncharted lakes in the forests of Alaska where plans were being made for hydro-electric development.

We are quite familiar with forest patrol by airplane, established in June, 1919, under a cooperative agreement with the Army Air Service. This agreement expired in 1921 and has not been renewed. Airplanes are still occasionally used on the Pacific Coast for taxi service on large fires or for patrol over especially hazardous areas and they will probably always be used, if funds and planes are available, as an adjunct to the ground-lookout system, for which purpose airplanes are admirably adapted.

Appropriations for airplane patrol for the detection and suppression of fires in the National Forests were $50,000 each for fiscal years 1920 and 1921. Their subsequent lack and the high cost of aerial patrol, together with the small percentage of "first report" fires received from airplanes, led the Forest Service to abandon this method of fire detection.

The Ohio Agricultural Experiment Station a State institution has furnished another instance of aerial farming. The city entomologist of Cleveland, after experiencing great difficulty in spraying some closely planted large trees in one of the suburban parks, conceived the idea that such a tract could be dusted from an airplane. He communicated his idea to the Ohio Experiment Station and enlisted the Army Air Service in the venture.

A hopper was designed by a specially detailed mechanic, to carry about 200 pounds of arsenate of lead powder which could be emptied into the air by a series of revolving spoons operated by a hand crank. The hopper was attached to the side of the fuselage so the occupants could not breathe the dust. The slip-stream and gravitation distributed the dust which was caught by the wind and carried through the tops of the trees.

The opportunity for testing the airplane idea was afforded by a grove of catalpa trees, six acres in extent, at Troy, O. This grove was defoliated by the catalpa sphinx caterpillar in June and the second brood came in

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force in early August and were stripping the new crop of leaves from the trees when the dusting checked them on August 4th, 1921.

Six passes by the grove were made by the machine, though it is believed less would have been sufficient. The time during which dust was spilling from the hopper was 57 seconds. The airplane passed about 50 feet out from one side of the grove and 20-30 feet above the tops of the trees. A strong wind carried the dust over the entire grove, nearly 400 feet wide and it could be found in easily perceptible quantities on weeds and grasses for 150 feet in the pasture on the distant side of the grove. Effective dusting was, therefore done over a width of about 600 feet or at the rate of about 10 acres per minute and since the passes can be reduced with perfected apparatus from 6 to 2, a normal rate of application may be expected to be about 30 acres per minute, says Mr. H. A. Gossard, state entomologist. Within 3 days after the application 99 per cent of the caterpillars were dead and were strewn on the ground, hanging from the trunks and limbs, making the grove indescribably foul and repulsive.

"I feel sure that one airplane can dust a strip of forest or a pecan orchard in less time than 20 of the most powerful liquid spraying machines can cover it.

"The problem is to perfect dusting materials so they will give results comparable with those obtained by liquid spraying.

"Applications of arsenate of calcium for case bearers and budworms on large orchards of big trees can probably be made more satisfactorily and expeditiously by airplane than with sprayers."

New Pursuit Planes for Selfridge Field

Selfridge Field, Mt. Clemens, Mich., has recently received several of the new PW5 Fokker Monoplane Pursuit planes. These are now in operation, being given daily service tests. Their value as Pursuit ships has not yet been determined.

Air Service Operates its Own Freight and Passenger Service

The Army Air Service does not have to rely on the railroads to transport its personnel and supplies. Aside from effecting considerable economy in transportation charges, the saving in time incident to using the fastest mode in transportation of the present day—the airplane—contributes not a little to the efficient operation of this branch of the military service. Very frequently, whenever it is found necessary to transfer officers and enlisted men from one station to another, some of them as far distant as 800 miles, the airplane furnishes an economical and rapid means of transportation. By using a Martin Bomber it is possible to transport five or six men at one time. A considerable number of enlisted men at the various Air Service fields who are detailed to take the course of instruction at the Air Service Technical School, Chanute Field, Rantoul, Ill., for training as mechanics, make the journey via the air route.

Some months ago, when the Air Service troops at Ellington Field, Houston, Texas, were transferred to Selfridge Field, Mt. Clemens, Mich., a distance of 1,600 miles, practically all of the personnel traveled to their new station by airplane. The entire cost of the journey by air was estimated at a sum $6,448 less than it would have cost the government had the movement been made by rail.

The Air Service, however, does not confine its transportation operations to passengers alone. A report recently received by the Chief of Air Service from the Commanding Officer of the Middletown, Pa., Air Intermediate Depot, states that in less than three months, beginning Jan. 1, 1923, and during a period of bad weather, 12,000 pounds of freight have been moved by air from that depot to various other Air Service fields. These shipments consisted of spare parts for airplanes and engines, aviator's clothing, and miscellaneous stores. Of this volume of freight, 1500 pounds were transported in DH4B airplanes, 4300 pounds in Martin Bombers and 6200 pounds in Handley-Page machines.

While statistics are not at hand showing what the other Air Service depots have accomplished in the way of transporting supplies by airplane, the activity of the Middletown Depot in this regard furnishes ample evidence as to what the Army Air Service is doing with reference to freighting its own supplies, and this in military planes which are not built for freight-carrying.

Unlike England, France, the Netherlands, and other foreign countries, the transportation of freight in commercial airplanes has not yet come into general practice in the United States. It would seem that, using commercial planes of suitable types, the transportation of freight via the aerial route presents unlimited commercial possibilities.

Master Craft Sign Co. Offers Special Service

The Master Craft Sign Co., with their place of business at 67 West Burnside Ave., New York City, is offering to Aviation interests a service which has long been wanted. R. J. Smith, and W. O. Waldecker, both well known in aeronautical circles, are applying their knowledge of Flying and Commercial aviation in general to Commercial Art and Advertising, for the benefit of all who require a service of this kind. With the assistance of an internationally known artist and various expert designers and illuminators, they cover the entire field of illuminating and designing as set down hereunder. At the time of writing Mr. Smith informs us that all kinds of orders are being received by the Company and are being executed expeditiously and with great care.

Aircraft Clubs, Flying organizations, and individuals wishing any kind of special designs, drawing, painting, sign, showcard, letterhead, private or club Menu, book cover, book plate, resolutions, advertisement, board sign, wood, metal, canvas, paper, or mat-board sign or Heraldry of an artistic or plain (in the case of aerodrome signs of warning to the public) should write to this firm before ordering elsewhere.

Mr. Smith says "I want to give to the Flying interests something out of the ordinary, something really good, valuable from an advertising point of view as well as an artistic one. I am putting my heart and soul into the work, and trust that I shall receive the support of the Flying fellows. Only work of excellent quality containing all necessary detail will leave the studio, although I am busily executing orders for firms outside of the Aircraft circle, I am specializing on aircraft designs for advertising purposes, etc., because of my love for flying. I will execute any order large or small, and cheerfully estimate."

Mr. Smith is late of the R. A. F. he also was Manager of the National Aircraft Underwriters Assn. and until returning East was Residential Aviation Engineer for the Pacific Coast for the Underwriters Laboratories. Mr. Waldecker, his partner is late of the United States Air Service.

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ELEMENTARY AERONAUTICS and MODEL NOTES

Allen Addresses A. E. S.

Mr. Edmund T. Allen, President of the Aeronautical Engineering Society at the Massachusetts Institute of Technology, has recently returned to the United States after spending several months in Europe where he has attended the various glider meets and has made a study of the science of gliding.

At a meeting of the A. E. S. on March 2, Mr. Allen, who is an authority on gliding, addressed the Society. His talk was an account of the French, German, and English competitions which he attended, and was illustrated by lantern slides showing the most prominent gliders participating in these contests. He described gliding as the greatest sport in the world, and believes it has an extremely promising future. Mr. Allen intends to continue his activities in the science of gliding to an even greater extent in the future.

After the meeting, moving pictures were shown of Allen's last flight in the second M.I.T. glider in Germany. In this flight the machine was wrecked, and seeing these moving pictures of the flight was Allen's first opportunity to determine exactly what happened at the time of the accident.

It will be remembered that it was Mr. Allen who was very largely responsible for the construction of the M.I.T. gliders by the Aeronautical Engineering Society a year ago. Last summer Mr. Allen, with O. C. Koppen and H. C. Karcher, comprising the M.I.T. glider team, took these two gliders to Europe where one of them was flown by Allen in the International Gliding Competition held at Clermont Ferrand, France. This machine was the only glider representing America in the Competition. During the time that Allen took part in the contest his performance was not excelled by that of all other competitors combined. He was later eliminated from the contest by an accident which disabled the glider. Mr. Allen later made some flights with the second M.I.T. glider in Germany, and since then has made a study of the art of gliding at the other meets which have been held.

The Composition of Various Metals

Aluminum is light in weight, possesses a high ratio of strength, is worked and will not rust. Its use for aircraft is extensive. It may be cast or welded.

Aluminum Bronze has nearly double the tenacity of gun-metal, is not liable to rust, and can be forged either hot or cold. It is composed of 90 parts copper and 10 parts aluminum.

Babbit's White Metal is composed of 10 parts tin, 1 copper, and 1 antimony.

Brass is an alloy of copper and zinc, with a small quantity of tin added to increase the hardness or vary the color. Lead may be added to increase the ductility and make it more suitable for turning or filing. It is very malleable and easily worked cold, but not fit for forging at a red heat. A good mixture is 2 parts copper, 1 part zinc.

Bronze or Gun-Metal is an alloy of copper and tin, but a little zinc is added to increase the fusibility. Tin increases the hardness and mixes well in all proportions for general purposes, 5 parts of copper to 1 of tin.

Cast-Iron contains from 2 to 5 per cent of carbon, is stronger under compression than wrought-iron, weaker under tension.

Copper is very tough and elastic, of considerable strength, malleable and ductile, suitable for hammering into forms requiring strength and elasticity combined with lightness.

Duralumin is a more recently developed alloy which is as strong as mild steel and only slightly heavier than aluminum. It is becoming more in use for aircraft every day. It will not permit of bending unless first annealed to soften it and then heat treated to restore or increase its strength. It may be cast but at present no satisfactory methods have been devised to weld it.

Manganese Bronze is a close-grained bronze, with a proportion of ferromanganese, can be rolled either hot or cold, very tough and strong, largely used for propeller-blades, etc.

Munts' Metal is composed of 3 parts copper and 2 parts zinc. It has a very high tenacity, very ductile, and can be forged hot, and if hammered or rolled cold can be used for springs.

Phosphor Bronze is very hard, tougb, close-grained alloy, composed of copper or tin with a small amount of phosphorus. Composition for bolts, etc., 90 per cent. copper and 10 per cent. phosphor tin to contain about 10 per cent. of phosphorus.

Steel is a compound of iron with from .1 to 1.5 per cent. of carbon; these kinds containing less carbon are more easily welded and forged, and are termed mild steel, used for plates and forgings. The presence of manganese increases the toughness and makes it easier to weld.

Wrought-Iron is nearly pure iron, produced by abstracting the greater portion of the carbon from cast-iron, that containing about ¼ per cent. being almost equal to mild steel. The longitudinal strength is increased by rolling, and the tensile is greater with the grain than across.

Zinc is brittle wben cold, malleable when hot. It is little affected by the air of weak acids and is therefore much used in coating metals to protect them from the action of the air or sea water.

(Concluded from page 240)

of Topeka is the Chairman of the Advisory Committee.

Iowa:

Davenport: Hon. Alfred C. Mueller, Mayor, is Chairman of the Advisory Committee, Mr. J. A. Russell is chairman of the Membership Campaign Committee with Mr. B. Richardson as Secretary.

Cedar Rapids: Mr. R. G. Grassfield is Chairman of the Membership Campaign Committee, Mr. Charles D. Manson, Secretary with the following members: Judge J. H. Treqin, P. C. Rude, Forest McCook, Victor Obenauer, and Peter Hoyt.

Waterloo: Chairman of the Membership Campaign Committee is Mr. Milo H. Miller, with the following members: Hon. W. W. Marsh, John T. Sullivan, and L. B. Strothman.

EIGHTH DISTRICT

The Chairman of the District Committee is Dr. Frederick Terrell of the City National Bank of San Antonio, Texas, with Mr. J. R. Riley as Executive Chairman and Treasurer, and Mr. George L. Rockwell of San Antonio also, as Executive Secretary.

Texas:

Galveston: Mr. Ralph Kern U. S. Engineer is Chairman of the Membership Campaign Committee.

Houston: Mr. Alva W. Snyder, is Chairman of the Membership Campaign Committee.

Oklahoma: Governor J. C. Walton is Chairman of the State Advisory Committee.

NINTH DISTRICT

The District Chairman is Mr. Cecil B. DeMille of Hollywood with L. F. Parton of San Francisco as Executive Secretary and Geo. B. Harrison of Los Angeles, secretary for the southern section of this district.

San Francisco: State Advisory Committee is made up of the following men:—Mayor Rolph, Chairman, Lt. Col. Gilmore, J. C. Irvine, Col. Ansen Wright, Albert Michelson, Judge Sylvester J. McAttee, R. Reed, Fred A. Tillman.

Los Angeles: The Advisory Committee is made up of Ewell D. Moore, George L. Metcalfe and Guy Moyston.

Nevada: Governor Scrugham is the Chairman of the Advisory Committee.

Utah: Governor Charles R. Mabey, is Chairman of tbe Advisory Committee for Utah.

NATIONAL AERONAUTIC ASSOCIATION,
Official: By: C. A. Tinker,
Director of Information.

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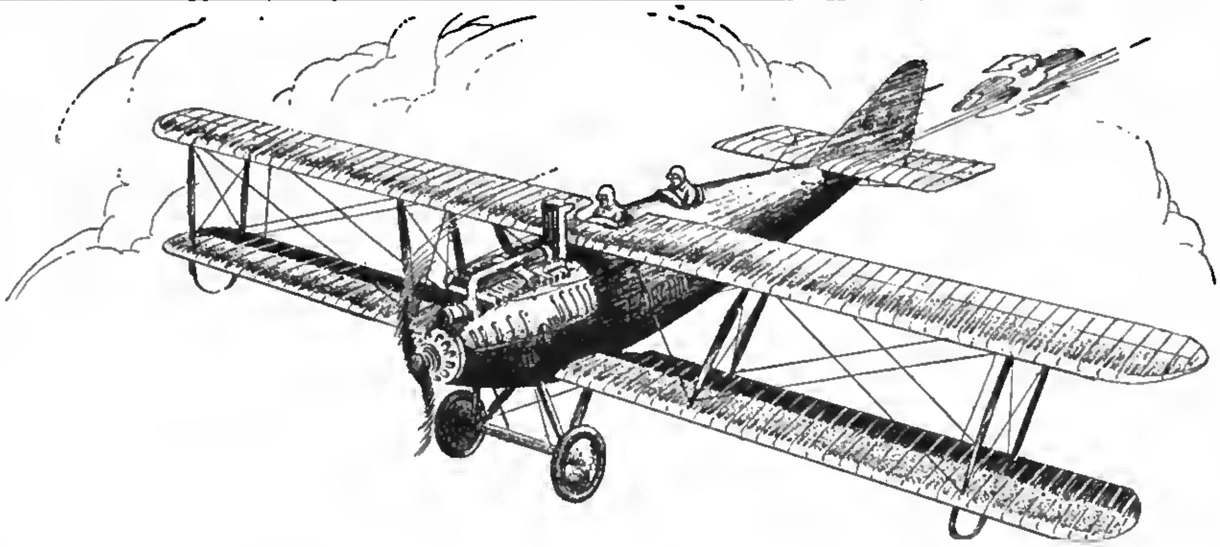

This Oriole Sees With a Camera-Eye

FAR aloft this Curtiss Oriole circles about, focusing whole sections of cities in her camera-eye. "Click" goes the shutter and another section is snapped, later to be pieced into a great mosaic map of the city.

This airplane has been used by the Fairchild Aerial Camera Corporation in photographing New York, Chicago, Trenton, and other cities. It has three years of service to its credit, and in that time has covered over 50,000 miles. Its outside surfaces are still in excellent condition due largely to the protective finish of Valspar Varnish.

Valspar is the standard all-weather varnish for airplanes. It gives sturdy, unfailing protection against sun, rain, oil, and gasoline—stands up under the most grilling tests of weather and travel. No wonder this service plane was finished with Valspar.

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Below is the lower end of New York as seen from the Oriole.

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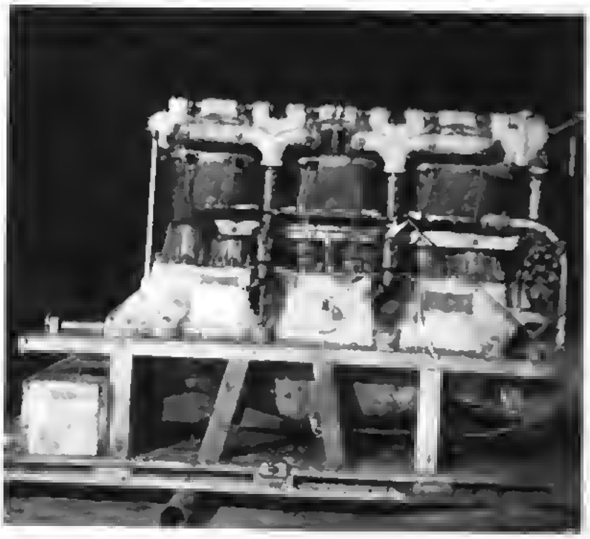

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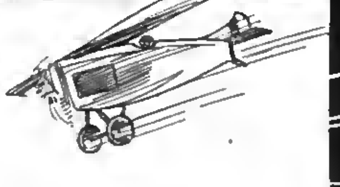

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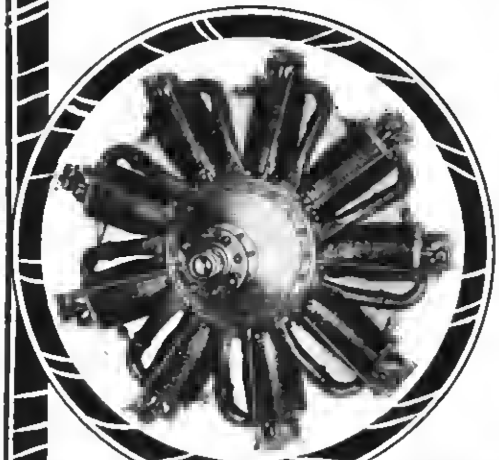

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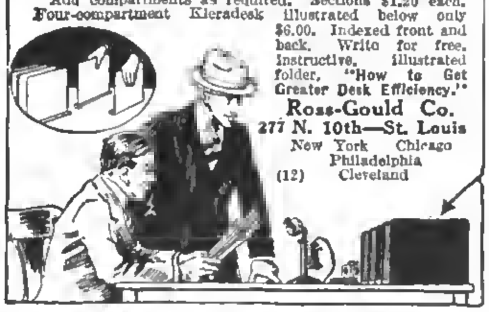

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Of AERIAL AGE published Monthly
at New York, N. Y. for April 1, 1923

State of New York }
County of New York } ss

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared G. Douglas Wardrop, who, having been duly sworn according to law, deposes and says that he is the Editor of the AERIAL AGE and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Aerial Age Company, Inc., 5942 Grand Central Terminal, New York; Editor, G. Douglas Wardrop, 5942 Grand Central Terminal, New York; Managing Editor, None; Business Manager, G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

2. That the owners are: Aerial Age Company, Inc., 5942 Grand Central Terminal, New York; G. Douglas Wardrop, 5942 Grand Central Terminal, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stocks, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is .... (This information is required from daily publications only.)

G. Douglas Wardrop

Sworn to and subscribed before me this 27th day of March, 1923.

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Air Mail Delivers Striking Evidence Against Inaction

By M. Clyde Kelly

The Race For Air Supremacy

By Rear Admiral Moffett

Air Travel With Reference to the Helicopter

By Major F. M. Green

The Martin-Navy All Metal Scout Seaplane

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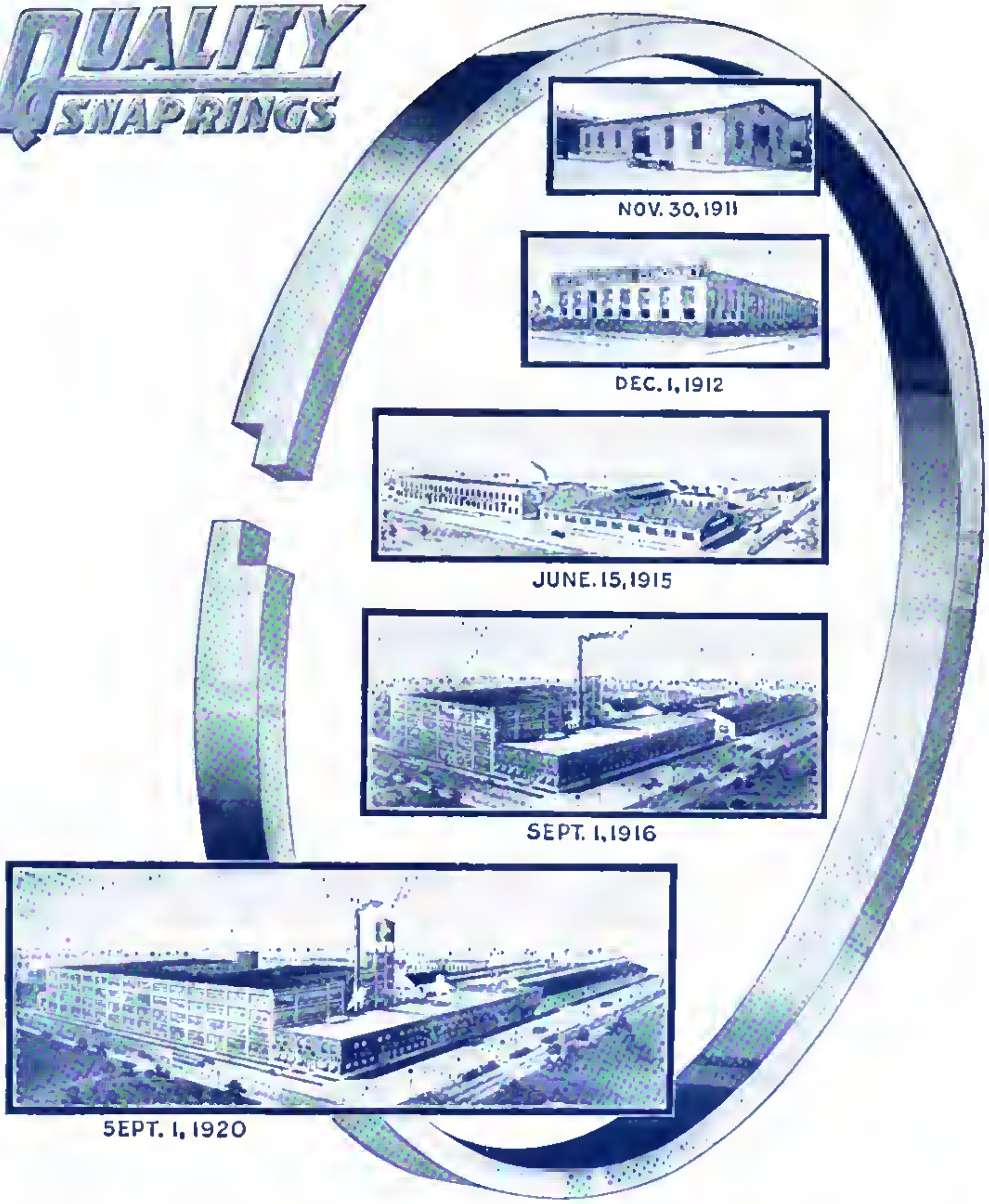

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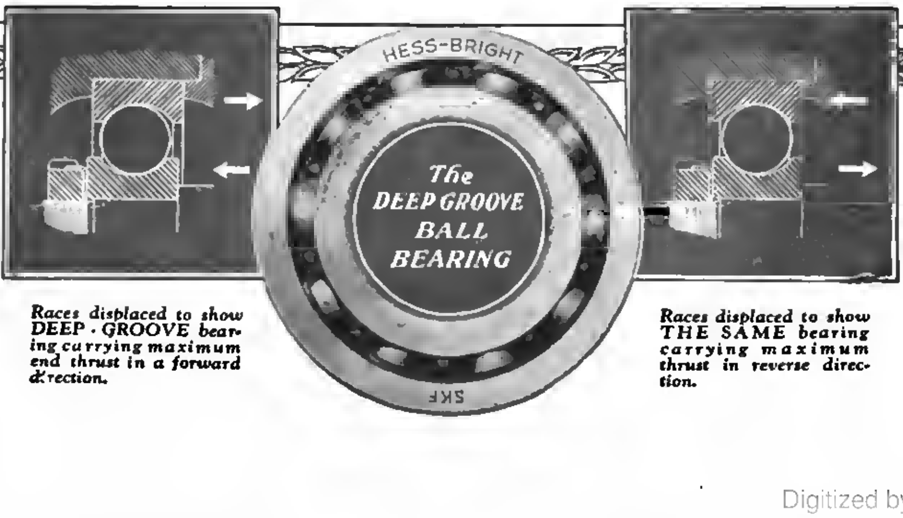

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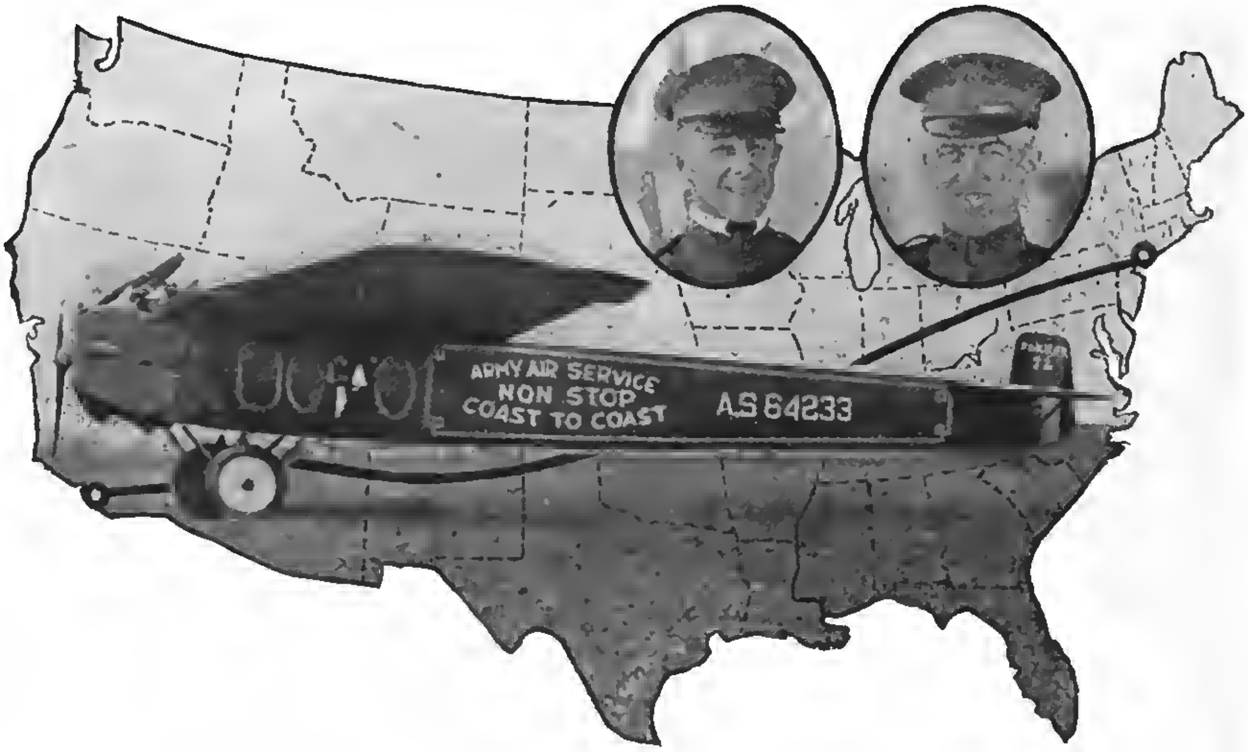

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The Race For Air Supremacy

Speech delivered by Rear Admiral W. A. Moffett, U. S. N., chief of the bureau of aeronautics, Navy Department, before the St. Louis Chamber of Commerce.

I WANT to render an accounting to you today of an enterprise in which you are all stockholders. That enterprise is your naval aviation service. It is the eyes of your fleet, and the guardian of your gateway to the world.

The matters of which I desire to speak to you have engaged the serious thought of individuals and nations throughout the whole world, during the past few years. As a result we find ourselves today with a challenge in the air—a race for air supremacy, commercially, industrially, and as an instrument for national defense. There is, perhaps, no nation in the world more concerned with problems of national defense at the present time, than is France. As a solution of these problems, she has developed the most powerful air strength in the world. Great Britain has of late years evidenced more concern for aviation development than she has for the strength and integrity of her fleet. The nations of the world and the great minds of the world recognize the fact that air supremacy spells national security.

I have never put forth the claim for aviation that it would revolutionize the world as regards national defense, or any other line of human endeavor. Aircraft are no more a substitute for armies and navies, than they are for automobiles. They are, however, a tremendously important factor in national defense, and they are destined to play an increasingly important part in our industrial and commercial life.

All of this leads us naturally to the question "What are we doing in this country?" and speaking for the Navy, I answer that question "As much as we possibly can." For we fully appreciate the fact that without aircraft our ships are well-nigh helpless, when pitted against ships which are served by strong and efficient aviation service. Economy has been the watchword in government expenditure in this country, and aviation in the navy has had to try to make one dollar do the work of two. Every penny that has been expended for naval aviation has been spent to develop aircraft for our fleet, and it has taken careful thought and planning to get a maximum return for our money. Bearing this in mind, I want to tell you what has been done.

We have, today, the best naval planes in the world, though they are relatively few in number. We have a comparatively small naval aviation force as regards personnel. As regards ability, efficiency, and high standards of morale they are the equal of any similar body of men throughout the world. It is our aim to equip every fighting ship in the Navy with aircraft, from the largest dreadnaught to the submarines. We are building for the Navy, and the work is being done by the Navy, the first rigid airship to be constructed in this country. We have developed a catapult for launching planes into the air from the deck of a battleship. We have successfully perfected means for directing and controlling the fire of battleships from the air. We have saved millions of dollars by developing aircraft carriers through experiments with the ex-collier Langley, rather than make costly mistakes with new types, and the results obtained are worthy of the best traditions of American ingenuity and resourcefulness.

We have perfected the torpedo plane which is, in effect, a destroyer in the air. Our air squadrons have just returned from a 7000-mile cruise to the Panama Canal, where they had an important part in the maneuvers of the combined fleets. From Guam to the islands of the Caribbean our interests are safeguarded by squadrons of aircraft, manned by Marine Corps pilots.

All of this sounds war-like and militant, but it only represents what is being done by your representatives in the Navy to keep faith with the trust that you have reposed in them, and it is a part of our duty to keep you informed of what is being done and of the needs of the navy, which are, in the final analysis, your needs. Within the past few years, we have had the greatest full scale lesson in preparedness in the history of our country. I do not need to point out to you the salient features of this costly lesson. They are known to all of us. But I must point out the fact that another such lesson which found us unprepared in the air, would probably result in a national disaster. You have heard military training as a measure of preparedness, urged by the most prominent leaders in the country. Every thinking man recognizes this as a measure of safety and sound economy. On the same grounds and of even greater urgency, is the need for aviation training throughout the country. In a national emergency, we could not create an air service over night. The building of air power is comparable to the building of sea power. It is based on years of experience and training. In the event of war, the cry would be for trained pilots by the tens of thousands. We have been unable to build up a reserve for naval aviation with the funds that have been alloted. We can barely meet the requirements of the active naval forces with these funds. We have only been able to build a solid foundation for our structure, but my warning is, that the structure itself cannot be put up in a day.

England and France are spending millions to create a reserve for aviation in the Army and in the Navy. This money is being expended in subsidy for commercial aviation. This country has even neglected to pass laws, regulating commercial aviation. Such laws would be a great stimulus to aeronautics, for they would stabilize commercial air transportation and facilitate its healthy growth by creating public confidence in aviation. This confidence is now lacking largely because of the uncontrolled and irresponsible "gypsy" flyers who operate without restraint and very often with unsafe equipment.

Another important consideration has been neglected, and this is the conservation of our helium supply. We are the only country in the world having a supply of helium adequate for an ambitious airship program. This supply of helium is a natural resource of incalculable value. It would enable us to develop airships on a scale which would be impossible in any other country in the world. Helium in airships practically eliminated the fire hazard, and this hazard has been the weakest characteristic of airships. The use of helium would be of tremendous advantage in the development of commercial airship transportation. Immediate measures should be taken by the government, looking to a comprehensive program of conservation of this valuable, natural resource. We are operating a helium plant at Fort Worth, Texas, at the present time, to supply our immediate needs, but there are other localities where helium can be produced, and where it should be conserved for the future.

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The Limitation of Armament Treaty allows to this country 135,000 tons in aircraft carriers, and a similar tonnage is allowed to Great Britain. The so-called 5-5-3 ratio is an acknowledgment by the world powers, that this country should of right maintain a Navy equal to that of any in the world. This, they have admitted is commensurate with the dignity of the United States and is a necessity to protect our interests. Our policy of non-participation in the counsels of Europe lends even greater force to this need. You may or may not have heard that we are not maintaining this status, as regards aviation. Great Britain has six aircraft carriers in commission—we have one. And that is an experimental type totally unsuited to war time uses. We have two carriers now building, but these will give us less of our allowed tonnage in these vitally important ships.

In conclusion, I would emphasize the following points:

No development of the age in which we live is of greater significance from a standpoint of national defense than is aviation.

The Navy has developed an aviation service of gilt-edge A-1 quality, but of inadequate size to serve our best interests. We are prepared to expand this organization when the vital importance of it has been borne in on the consciousness of the people to whom it belongs.

AIR MAIL DELIVERS STRIKING EVIDENCE AGAINST INACTION

Record of Four Years and Seven Months Wins World Commercial Transportation Leadership for United States

By M. Clyde Kelly

Member of Committee on Post Offices and Post Roads in the House of Representatives; Lawyer; Publisher.

RECENTLY one of the world's greatest manufacturers said of aviation, "About all we have learned so far is that we can fly; the rest is yet to be learned." Perhaps that is the average man's conclusion. I have just received the detailed statement statistically presenting the performance of the Air Mail Service since its inauguration May 15, 1918, to Dec. 31, 1922—four years and seven months. This statement shows that not only have we learned how to fly in any condition of weather, but that we have put flying to a very practical use. We have demonstrated to the country that the commercial usefulness of the airplane surpasses in reliability and speed all other means of transportation on land and water.

No language can be extravagant in expressing the marvelous record of our Air Mail. Language is a poor vehicle because one can not hope indelibly to impress upon the minds of the people, and especially the consciousness of our men and women whose activities are making this nation great, the stimulating facts of the Air Mail. Words do not suffice to prove that with the Air Mail this country has grasped the palm of world leadership in this new phase of air transportation. I wish it were possible to engrave upon every active mind these facts:

For four years and seven months the Air Mail Service—

Made 90.39 per cent of all deliveries.

Flew through fog, rain, snow and hail 36.33 per cent of that time, or 20 months of storm out of the 55.

Air Mail planes traveled with mail 4,623,115 miles, or an average of 84,056 miles a month.

Air Mail planes carried 160,473,600 letters, an average of 2,917,884 letters a month.

Of the 24,988 trips scheduled, only 873 were uncompleted.

An Airplane is a single unit—and no single transportation unit I dare say in all history has approached Air Mail plane efficiency over a period of four years and seven months.

The air conditions that the Air Mail meets with such extraordinary performance are the most varied to be found on the earth's surface. The records cited were daily schedules on the New York-Washington route; the Chicago-St. Louis route; the Minneapolis and St. Paul-Chicago route; New York-Cleveland and Cleveland-Chicago routes; Chicago-Omaha and eventually Omaha-San Francisco—terrain with three mountain ranges, the Allegheny, the Rocky and the Sierra.

It is right and just to declare that the entire performance of the Air Mail Service stands alone at the peak of all transportation records. It stands as an achievement for the world to aim at, and it stands, too, as the example for the business people of the nation of what is practical in air transit in commercial carrying of goods and passengers. Nothing, in my opinion, that the National Aeronautic Association can advance to convince our people that it is a patriotic duty for them solidly to support the movement, to foster, encourage and advance aeronautics can make the impress that these convincing facts of the Air Mail Service must make upon the minds of those who are capable of constructive thought.

Since the inauguration of the New York-San Francisco service in September, 1920, the Air Mail has flown an average of 137,686 miles with mail every month, or nearly six times the distance around the earth at the equator every thirty days, although the Air Mail does not fly on Sundays and holidays. Phineas Fogg of my boyhood with his fictional trip around the world in 80 days has certainly evaporated and isn't even a myth in reckoning the day by day work of our Air Mail pilots.

We have planned some startling tests for our American aircraft, polar voyages in our new airships, actual world-circling flights, and an over land and sea route to China. But to me, as a business man, such projects pale into insignificance so far as they affect the practical side of affairs alongside the performance of the Air Mail Service. That is actual; it stands solidly on known efficiency; it shows the way to a real utility that can benefit all the people; it demands that the mail must fly everywhere so that our Post Office Department shall be genuinely a department of communications.

What are we waiting for? We have proved the advantages of aerial mail transportation by nearly five years of the hardest kind of test. Why do our industries, our commercial and financial interests, our agriculturists want further to show that the air ocean is a free sea for transit that will give them and all of us the greatest boon yet vouchsafed mankind?

The Air Mail must cover a network of air lanes between all the important centers of the country, not

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alone because airplanes annihilate time and distance but because they have attained a standard of scheduled transit that approximates a degree of perfection no other means affords. Give the Air Mail the rate of the star route carriers of two cents a letter and it is entirely within reason to look for the service to operate at a handsome profit after deducting all expenses, capital account, depreciation, etc.

What are we waiting for? Commercially the airplane is a success. Then why does business hesitate and stand in its own light instead of getting behind the commercial advancement of airplane carrying of goods and passengers and profiting by it? It is perhaps due to our characteristic hesitancy, our ultra conservatism, if you will. The airplane on the mail routes for more than four years has shown us a timidity in feeling that nothing good remains to be discovered is a fallacy. The warranted enthusiasm over the Air Mail record of performance breaks down conservatism as a means of defense. The proof is submitted. Character, capacity, utility, profit are there in the figures of the Air Mail Service—proved by trial for 55 months.

Why content ourselves with the feeble expression, "The mail must fly!" in the hope that the people and their representatives in the Government will hear it and force the issue? The mail does fly better than 95 per cent across the continent. Business can, if it shelves its timidity, make it fly over the entire continent as nearly perfect as human ingenuity can approximate perfection. Business is a heavy loser today and every day that it clings to its conservatism so close that commercial aeronautics remains a puny infant. What are we waiting for?

The Martin-Navy All Metal Scout Seaplane

TESTS have just been completed on Lake Erie at Cleveland of the Navy's latest seaplane, the MS1, designed by the Navy for shipboard use and developed by the Glenn L. Martin Company. So far as is known, it is the smallest seaplane ever built.

This "mechanical humming bird" is entirely of metal with the exception of the covering, and is only 18 feet wide, 17½ feet long and 7½ feet high from the water line. Its actual weight is less than 650 pounds. Notwithstanding its small size, it is a real airplane, handling and maneuvering in the air as well as much larger planes. While it is not permissible to give actual performances, its speed is quite high, considering that it is a seaplane and that its motor is of low horsepower.

The power plant is a Lawrance, model L 4 S, three cylinder, air-cooled motor of 60 h. p. It carries a 6½ foot propeller. The motor is mounted on a vertical bulkhead at the end of a rectangular fuselage built up entirely of steel tubing. The method of assembling the fuselage is worthy of special note. It is built in a jig, the various members being held in place by special clamps until all the fittings have been made. This results in a perfectly rigid structure which requires practically no truing up. The fittings themselves are quite simple being attached in place by rosette welding. This method, which was developed at the Martin factory, consists of drilling holes through both the main members and the fittings and torch-welding the material around the radius of the holes. Tests on this type of fitting have shown exceptional strength while it also allows for a minimum of weight.

The Martin-Navy All Metal Scout Seaplane

The pilot's cockpit is roomy and all the controls and instruments are readily accessible. Outside of radio equipment, no military load is carried.

The tail surfaces and wings are made up entirely of duralumin, channel sections being used largely for the bracing, while the ribs are stamped out of the material in one piece. Two-inch tubular duralumin is used for the wing beams. The leading and trailing edges are of channel duralumin riveted to the ribs. The wings, as well as the fuselage and tail surfaces, are covered with linen.

The wing interplane bracing is accomplished by one set of "N" struts on each side. The flying and landing loads are taken by diagonal struts between the floats and the outside of the lower wing. The lower wings are attached to the fuselage bottom longerons, while the upper wings join at a cabane section above the fuselage. This arrangement permits of easy assembling or dismantling in case it is desired to stow the plane in a very small space.

Unique in seaplane construction are the floats. These are entirely of duralumin, the structure being built up of channel section bracing with water tight bulkheads. The float fittings for the brace struts to the plane structure are aluminum alloy castings. Sheet duralumin is used for the float covering. All joints are made water tight by the use of wicking, impregnated with marine glue, placed in the joints at the time of riveting.

All interplane and float struts are streamlined with sheet duralumin. The gasoline tank is of welded aluminum and holds twelve gallons—sufficient fuel for a flight of two hours at full speed.

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Flying a Peaceful Pastime

OH, TO BE an aviator! "Far from the maddening crowd's ignoble strife" flies Folly H—— of the flight test field and his fancy flying pals.

On they come from Kelly and Mitchell and everywhere, carefree, conscientious, peppy, two-fisted—fighters from the word "go" and out they go when they're through. Christians they are, with the fear o' God in their hearts or else they're pushin' up the daisies.

Gi' *me* the old crate and I'll fly her. And they do.

The life of a test pilot at McCook Field certainly can't be called dull. There's something new all the time.

See that bird over there! That's ——, chief of the flight test department. They gave him one of those side-door Pullman monoplanes, with the cockpit just big enough to stick your head through after you wriggled in through the door like a worm. He's *got* something on the ball. Not for mine! I don't mind an archie or two bustin' under my tail but nix on this test stuff. He took this bus out one day and I'm here to say that I don't envy him, not a damn bit. Foxy Granpa, you know who I mean, well, Foxy and he were side kicks and Foxy went along in an MB3 just to see what he should write home. Natcherly, they started a little combat stuff and they milled around a bit and Foxy got on his tail.

They kept on buzzin' aroun' and first thing that happened, one of H——'s ailerons came off and then the other one and next a wing and pieces then began comin' off all over the ship. H—— kept dropping faster and faster till Foxy couldn't follow him down. But he saw H—— struggle through the baby door and roll over the top, pull his 'chute, and it opened. H——'s stick had been whipping and his legs were blue and swollen. The ship hit in the backyard of a house and splattered oil all up and down the side of two nice white stories and H—— lit in the grape arbor.

Granpa told me, one day when we were feebly hoistin' the last coca cola, that every time he has a nightmare he lives through it all over again, him droppin' with the 'chute and the ship follerin' him down.

And then, there's the story of Lieut. T——, test pilot of the Boening plant. Reports seemed to be gathering that America's pursuit plane had a tendency to disintegrate in flight. T—— naturally wouldn't take anyone else's word for it so he took the "ship" off to about five thousand and dove with a wide open engine for a thousand feet, leveled off and barreled. He just remembers flattening out and giving her the rudder. The fuselage turned over all right but the wings stood still, apparently. That was his impression, at any rate, hazy as it must have been. There he was, upside down in the fuselage with nothing left but the tail.

T—— merely undid the strap, pulled his 'chute and came down just like any good weight would. He wasn't satisfied with this but tried it again the next month—and with the same result.

And they give medals for knockin' down bosches!

N—— was a test pilot at McCook. "Was" is right. They decorated his two by six some time since. He took up one of our well known foreign monoplanes, of which we've just acquired ten or so. All we know is that he went up and started some combat work with Foxy Granpa; Granpa went into a turn and when he came out N—— was gone. They found him and the fuselage and the engine on the banks of the Miami. The wings, or pieces of them, were scattered here and there about the countryside.

Sure they sand test 'em and everything. Mathematical gymnasts and scientists and experts figure out the safety factors for dives and barrels and all that but they don't figure on what a bird can really do with a stick.

One of Granpa's stunts was to take the Baby Gax, with the new 300 Hisso, out for an airing. When he opened her up the engine jumped out, turned upside down and landed back in the bed. If it hadn't been for the armored cowl the engine would certainly have fallen through and got all bunged up.

It's a great life. Somebody in the drafting room develops a new idea but the test pilot flies it. Anything with wings comes his way and he's right there with the goods. If it'll fly at all, it *will.* The test fields get the wildest mustangs. A year and they make 'em Christians. The old time pep is gone. Test piloting is killing work, metaphorically speaking. The human body just won't stand the strain.

So much for the test pilots. It's a funny thing, this luck proposition. There was Fonda B. Johnson who was one of the men assigned to the Verville-Sperry in the Pulitzer. I say "was" advisedly for he may still be with us in the spirit. But Johnson was a "nut" on parachutes. He was also long on sand and had unlimited guts. "I've seen him at Mitchell, at Kelly—everywhere; and he was always totin' his old brown 'chute. He was in charge of pursuit tactics at the pursuit school in Texas when Mitchell was coming down for an inspection. They put it up to Johnson to put on a stunt formation—SE5's or maybe it was Spads. He takes the formation up. Every man was a competent pilot. Fonda B. says 'We will go up and you two men will do right hand rolls and I will do a reversement and come out, then you do a left-hand climbing turn and I'll do so and so. So there'll be no mistake I'll write everything down on paper.'

"Well he writes it all down on paper and we all hop off to practice our stuff. Well, the first stunt or so went O. K. and then something missed. Fonda's list said a left hand stunt turn. He signaled and then started to the right. Of course the man behind him knocked his tail off. Here was Fonda B. Johnson, the parachute fanatic of the Air Service, and he didn't have his 'chute. The other bird lost a wing. Johnson lost his tail at 2000 feet and the only other man with a complete ship followed him down to see what would happen. Fonda works on his ailerons and his engine until he gets down to fifty feet from the ground, cuts both switches, puts his arms over his head and lets the . . . . . hit and burn. That was the end of Johnson.

"It was after this that Sperry said 'I am going to make a parachute a habit.'

"You can't replace Johnson. There aren't any more like him. The same thing goes on year in and year out. Here's where we get our old 8 per cent stuff and 2 per cent incapacitated annually and here's where we want a separate promotion list," says the pilot.

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Multiple Spark Plugs May Mean More Power

THE Engineering Division of the A r m y—m o r e popularly speaking, McCook Field—has for the moment added to its solutions of the airplane fire annoyance and the production of better and better pursuit and other types of American airplanes, and considered the possibility of getting more of the bee-tee-you's out of gasoline.

Tests have been conducted to determine the effect of variations in the position and number of spark plugs.

At the following general conclusions there has been an arrival considering the spark set for best power in all cases:

"With detonation eliminated—

1—"There is no definite drop in power with reduction in the number of plugs until ignition is restricted to one side of the combustion chamber.

2—"There is little difference in power between intake and exhaust plug operation.

3—"The required spark advance increases as the number of plugs decreases.

"With detonation tendency—

1—"The power increases with an increase in the number of plugs.

2—"The intake plugs appear to give better power than the exhaust plugs.

3—"The spark advance for maximum power varies in general inversely as the number of plugs in operation.

4—"Greater spark advance is possible with intake than with exhaust plugs."

Tests were made with two similar types of cylinders—model W-1 of 5.5 by 6.5 bore and stroke; and model W-2 of 6.5 by 7.5 inches. These cylinders have four spark plug bosses located horizontally in the sides of the combustion chamber at 90° as shown in the illustration. They were mounted individually on the universal test engine (attached to a 100 h. p. Sprague dynamometer) and fitted with four single-cylinder Dixie magnetos, with selective switches, making possible operation with any combination of plugs. A rotary spark indicator—a revolving pointer and stationary protractor ring forming a rotary gap—was provided to indicate the actual spark setting at each condition. In all cases the spark was set at a position of maximum power.

Following are the conclusions:

Influence of the Number of Plugs

With detonation eliminated, four plugs, three plugs, and two (180°) plugs appear to give about the same m. e. p. A definite drop is obtained when two (90°) plugs or single plugs are used.

Where detonation limits the spark setting, a definite drop in m. e. p. results from a decrease from four to three plugs. The difference between three and two (180°) plugs is slight. There is a distinct drop in power effected by a change from two (180°) plugs to two (90°) plugs, but little difference between two (90°) and single plugs. In general the power is increased by an increase in the number of plugs in operation when the detonation tendency is present.

Influence of the Position

In 3-plug combinations, it makes little d i ff e r e n c e in performance whether a combination of two intake and one exhaust, or vice versa, is used.

In 2-plug combinations, any combination of one intake with one exhaust seems to show better power than two intake or two exhaust plugs. Plugs at 180° in all cases show better performance than do plugs at 90°.

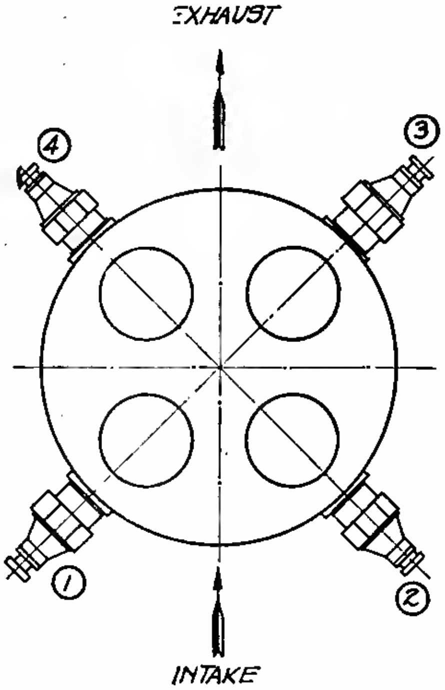

Diagram of the Location of Plugs

With detonation eliminated there is little choice between exhaust and intake pairs, but the intake plugs appear to show better power in the presence of the detonation tendency.

With single plugs, where detonation is eliminated, slightly better power was obtained with exhaust plugs. Where the spark advance is limited by detonation, however, the intake plugs give better power.

Influence of Number, Position and Detonation on Spark Advance

With detonation eliminated, the spark advance for maximum power increases as the number of plugs decreases. In the presence of detonation the spark advance for maximum power varies less definitely; in general, increasing, however, with the decrease in the number of plugs.

Variation of spark advance with the position of plugs: (a) In 3-plug combinations, under no circumstances, is there an appreciable variation of spark advance effected by a change from one intake and two exhaust plugs to one exhaust and two intake plugs. (b) In 2-plug combinations with detonation eliminated, 90° plugs appear to permit slightly more advance than do 180° plugs. In the presence of detonation, greater advance is possible with intake than with exhaust pairs of plugs and considerably more advance with 180° plugs than with 90° plugs. (c) With single plugs, without detonation, there is little difference between the advance for best power with intake and exhaust plugs. With detonation, less advance is possible with exhaust than with intake plugs.

Here is an opportunity for airplane and automobile engine manufacturers to take advantage of some of the cost of Governmental experimentation. Will it mean more power for the same weight, or a reduction in size and weight for the every-man airplane? Thus far the increase in power by use of our plugs seems to be about 2½ per cent.

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Five Million Miles Through the Air

FIVE million miles through the air; this is the sum total of activities of the Air Mail Service of the Post Office Department, since its inauguration May 15, 1918 to December 31, 1922. At the present time the Air Mail Service is flying on a schedule estimated to require nearly 2,000,000 miles a year, and it is estimated that the postal planes are rapidly winging their way to the 6,000,000 mile mark.

The consolidated statement for five years of operation of the Air Mail Service just issued by Postmaster General New also reveals that the percentage performance during the whole period is 90.39, a relatively high figure. (Of the 5,281,823 miles flown up to December 31, a total of 4,623,115 miles was traveled with mail.)

The Air Mail Service since its installation has cost, the report shows, $4,295,967.69. Much of this expense has been for permanent improvements such as, repair shops, development of landing fields, and the creation of a reserve ship supply. In their flights running into millions of miles the mail pilots have carried 160,473,600 letters. That this number will increase rapidly is indicated by the fact that for last year alone planes carried more than 60,000,000 of that total.

The Air Mail Service has even compiled statistics which definitely establish the fact that a mail pilot's life is not all sunshine. More than one third of the trips undertaken, 8,373, were made in rain, snow, hail or fog; 14,704 trips in five years operation were made in clear weather. Although the pilots were compelled to make 3,088 forced landings, the yearly total was cut from 1,473 in 1921 to 573 in 1922. For this record increased skill on the part of pilots and a rigid inspection system for planes, is entitled to credit.

The percentage performance is gradually creeping higher and higher as the Air Mail Service becomes established. In 1918 the percentage was 94.09, but neither this nor the year following were representative years since only the short line between New York and Washington was in operation. In 1920 when the activities were gradually spreading out and the trans-continental route was embarked upon, the performance, that is, the number of trips completed in comparison to the number scheduled, fell to 78.04 per cent. In 1921 it had risen to 92.84 per cent, and in 1922 it was 95.52 per cent. During 10 weeks of last summer the schedule was maintained 100 per cent perfect.

In addition to the trans-continental route, air mail service is now maintained between Havana, Cuba and Key West, New Orleans and Pilottown and Seattle and Vancouver. The New York-Washington route was maintained until May, 1921. St. Louis to Chicago, and the Chicago to Minneapolis runs were started in 1920 but they also were discontinued in 1921 leaving only the trans-continental service, New York, Chicago, and San Francisco, which was established September 8, 1920, in operation over land. The trans-continental route is maintained directly by the Post Office Department, while the Seattle, New Orleans, and Key West services are operated under contract.

Torsion Test Rig-Up for Universal Testing Machine

IN order to secure information for use in the design of rudder posts, elevator spars, and aileron beams for aircraft, torsion tests of such members are necessary. No torsion testing machine readily adaptable to large specimens in a variety of shapes, being available, engineers at the Forest Products Laboratory, of the Forest Service, Madison, Wisconsin, built the apparatus which is here shown mounted on a universal testing machine.

Universal testing machine developed by the Forest Products Laboratory

A specimen for test is secured in the two large disks which hold its ends, the motor is started, and the motion of the descending crosshead of the machine is transmitted to the disks by the straps attached to the short beam (shown end foremost) bolted to this head. As this movement is received by the disks it is resolved into a rotation (counterclockwise for the nearer disk and clockwise for the further one), and a downward motion of both disks with the specimen. This downward motion when measured at the center of the specimen, proceeds at half the speed of the crosshead of the machine. The pull on the disks is, by means of the supporting framework, communicated to the weighing platform on which the lower horizontal beam rests, and registered on the weighing dial of the machine.

The amount of distortion in the specimen, caused by the opposite turning of the disks, is measured by the relative rotation of the arcs fastened to it. As the specimen twists,

(*Continued on page* 282)

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Note on the Determination of Longitudinal Control Forces of Airplanes During Horizontal Flight

IT IS often desired to obtain an estimate of the control forces of airplanes equipped with unbalanced elevators. The magnitude and direction of the stick force during normal flight is indicative of the stability of the ship and the ease with which it may be flown. The machine will be stable, from the pilot's standpoint, if the curve of stick force against velocity has a negative slope—a pull on the stick being taken as positive. The principal factors which govern the longitudinal control of the airplane are (1) location of the center of gravity, (2) hinge moment due to the weight of the elevators, and (3) slipstream effect on the tailplane. It is apparent that the statical moment of the elevators about the hinge cannot appreciably influence the slope of the stick force curve. In the present analysis, slipstream will be neglected.

The following additional conventions will be noted:-

1. Stalling moments are taken positive.
2. The angle of attack of the tailplane is referred to the zero lift line with neutral elevators, and is measured in the same sense as that of the wings.
3. The angular setting of the elevators is referred to the original chord line with neutral elevators. A positive elevator angle produces a decrease of pitching moment, and vice versa.
4. Hinge moments are positive if they tend to increase the angular setting of the elevator.

Now repeated tests of tailplanes show that, throughout the range of elevator angles employed during normal flight, we can represent approximately the characteristics of the tailplane by expressions of the forms:

$$C_{lt} = a\xi + b\eta \qquad (1)$$
$$C_h = a'\xi + b'\eta$$

where the lift coefficient C_l is defined by

$$C_l = \frac{L_t}{q S_t}$$

where L_t = lift; q = dynamic pressure corresponding to the given air speed, S_t = total tailplane area.

The hinge moment M_h due to the air load is designated by

$$C_h = \frac{M_h}{q S_t^{3/2}}$$

In (1) and (2) the tail angle of attack is designated by ξ and the elevator angle by η; and the a's and b's are constants. It is readily seen that (1) and (2) may be written

$$C_{lt} = a(\xi + K_1\eta) \qquad (3)$$
$$C_h = a K_2 (\xi + K_3\eta) \qquad (4)$$

where $K_1 = b/a$, $K_2 = \dfrac{a'}{b'}$

and $K_3 = \left\{ \dfrac{b'}{a'} - \dfrac{b}{a} \right\}$

The constants K_1, K_2 and K_3 depend principally upon the ratio of elevator area to total tailplane area. They are influenced to some extent, of course, by the shape of the tailplane. However, the various model and free-flight tests in this country and in England indicate that there are not very appreciable differences in the values of these constants for the same ratio of elevator area to tailplane area, for rectangular and trapezoidal forms. One would not then expect very large differences in the values of K_1, etc., with tailplanes of not too greatly different shapes; (although more tests on tail planes are certainly desirable).

In the formulas (3) and (4) the angle of attack ξ, is referred to the zero line of the section with elevators neutral. Then a is simply the slope of the lift coefficient curve of the tailplane with neutral elevators, i. e.,

$$a = \left\{ \frac{\delta C_{lt}}{\delta \xi} \right\}_{\eta = 0}$$

When the slope, a, of the lift curve of the section has been determined from tests on model aerofoils, a correction for aspect ratio should be applied before substituting a in (3) and (4). The approximate aspect ratio correction to the lift curve slope is given approximately by

$$a = \frac{a_0}{\dfrac{57.3}{1-\pi}\left\{ \dfrac{1}{\lambda_0} - \dfrac{1}{\lambda} \right\}} \qquad (5)$$

where a_0 is the slope on the basis of a test on a model aerofoil of aspect ratio λ_0.

We begin the analysis for control forces by noting that

$$F = m\,(M_h + M'_h)$$

where F = control force
m = gearing of elevators
M'_h = statical hinge moment of the elevators.

The stick force is

$$F = m\,q\,S_t^{3/2}\,C_h + m\,M'_h \qquad (6)$$

or substituting the value of C_h

$$F = m\left\{ q\,S_t^{3/2}\,a\,K_2\,(\xi + K_3\eta) + M'_h \right\} \qquad (7)$$

It is now only necessary to substitute the values of ξ and η. The elevator angle η is fixed by equilibrium conditions. Let the moment of the machine without the tailplane be written in the form

$$M_w = C_{mw}\,q\,Sc$$

In case a model test can be made M_w is very approximately determined by testing the model for moments with and without the tailplane. If no model test can be conducted, the pitching moment due to the wings may be conveniently found by first calculating the moment about the leading edge and then transferring this moment to the desired point relative to the wing. Take the origin on the leading edge in the plane of symmetry. Then the moment about the leading edge is given by

$$M_{le} = -\frac{pc}{100}\,\frac{L\cos(\gamma-\alpha)}{\cos\gamma} \qquad (8)$$

when p = distance from leading edge to center of pressure in percent of wing chord.

c = wing chord
L = lift

$$\gamma = \cot^{-1}\left\{ \frac{L}{D} \right\}$$

α = wing angle of attack.

The moment about any other point with co-ordinates (x y) referred to a set of axes with the origin in the leading edge (in the plane of symmetry) and with the z-axes drawn upward above the wing and the x-axes backward toward the trailing edge is

$$M_w = \frac{L\cos(\gamma-\alpha)}{\cos\gamma}\left\{ x - \frac{pc}{100} - z\tan(\gamma-\alpha) \right\}$$

which gives for the moment coefficient of the wings about the center of gravity

$$C_{mw} = \frac{C_l\cos(\gamma-\alpha)}{\cos\gamma}\left\{ \frac{x}{c} - \frac{p}{100} - \frac{z}{c}\tan(\gamma-\alpha) \right\} \qquad (9)$$

when the lift coefficient of the wings is defined by

$$C_l = \frac{L}{q\,S}$$

where S is the *wing* area.

If the moment coefficient C_m about the leading edge is already given then

$$C_{mw} = C_m + \frac{C_l\cos(\gamma-\alpha)}{\cos\gamma}\left\{ \frac{x}{c} - \frac{z}{c}\tan(\gamma-\alpha) \right\} \qquad (10)$$

when

$$C_m = \frac{M_{le}}{q\,Sc} = -\frac{p\,C_l}{100}\,\frac{\cos(\gamma-\alpha)}{\cos\gamma}$$

The pitching moment due to the wings etc., must equilibrate that due to the tailplane. For normal flight conditions with open throttle, the thrust is nearly equal to the drag so that the moment equation is approximately

$$C_{mw}\,q\,Sc - h\,(q\,S\,C_d) - l\,q\,S_t\,C_{lt} = 0 \qquad (11)$$

when h = arm of propeller thrust with reference to the C. G., L the effective lever arm of the tailplane, S, the wing area, and C_d the drag coefficient for the complete airplane.

Solving (11) for C_{lt} and equating the result to (3) we find that

$$\eta = \frac{c\,C_{mw} - h\,C_d}{Q\,c\,a\,K_1} - \frac{\xi}{K_1} \qquad (12)$$

where

$$Q = \frac{l\,S_t}{c\,S}$$

For tractor types Q usually lies between 0.35 and .42, the lower figures applying to machines of the bomber or transport classes while the higher values hold for pursuit types.

The value of ξ is of course simply

$$\xi = \alpha - \epsilon + \beta$$

when β is the angular setting of the stabilizer to the wing chord, and ξ the wing downwash angle. Then

$$\xi = \alpha\left(1 - \frac{d\epsilon}{d\alpha}\right) + \beta \qquad (13)$$

where in general $\dfrac{d\epsilon}{d\alpha}$ is constant and equal to about 0.55.

Next consider the conditions for a stable form of stick force curve: Neglecting slipstream, the initially independent variables may be taken as V, α, and η.

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We can then write directly

$$\frac{dF}{dV} = \frac{\delta F}{\delta V} + \frac{d\alpha}{dV} \left\{ \frac{\delta F}{\delta \alpha} + \frac{\delta F}{\delta \eta} \cdot \frac{d\eta}{d\alpha} \right\} \quad (14)$$

the condition for stability being

$$\frac{dF}{dV} < O \quad (15)$$

The derivatives are found as follows:

(1) $$\frac{\delta F}{\delta V} = \frac{2q}{V} \frac{\delta F}{\delta q}$$

or $$\frac{\delta F}{\delta V} = \frac{2q}{V} m S_t^{3/2} a K_2 (\xi + K_3 \eta) \quad (16)$$

where η and ξ are found from (12) and (13)

(11) $$\frac{\delta F}{\delta \alpha} = m K_3 q S_t^{3/2} a K_2 \cdot \frac{d\xi}{d\alpha}$$

$$= m K_1 q S_t^{3/2} a K_2 \left(1 - \frac{d\epsilon}{d\alpha}\right) \quad (17)$$

since

$$\frac{d\xi}{d\alpha} = \left\{ 1 - \frac{d\epsilon}{d\alpha} \right\} \quad (18)$$

(III) $$\frac{\delta F}{\delta \eta} = m q S_t^{3/2} a K_2 K_3 \quad (19)$$

(IV) The conditions of equilibrium of the airplane allow us to determine $\frac{d\alpha}{dV}$ very easily. Neglecting the small variations in lift due to changes in the elevator setting

$$dL = \frac{\delta L}{\delta \alpha} d\alpha + \frac{\delta L}{\delta V} dV = O$$

for steady horizontal flight. Hence

$$\frac{d\alpha}{dV} = -\frac{\left\{\frac{\delta L}{\delta V}\right\}}{\left\{\frac{\delta L}{\delta \alpha}\right\}}$$

But since

$$L = C_l q S$$

Hence

$$\frac{d\alpha}{dV} = -\frac{\frac{2C_l}{V}}{\frac{dC_l}{d\alpha}} \quad (20)$$

(V) From equations (12) and (18)

$$\frac{d\eta}{d\alpha} = \frac{1}{Q a K_2} \left\{ \frac{dC_{mw}}{d\alpha} - \frac{h}{c} \frac{dC_d}{d\alpha} \right\} - \frac{1}{K_3} \left\{ 1 - \frac{d\epsilon}{d\alpha} \right\} \quad (21)$$

In using the formulas care must be taken to note that C_d is the absolute drag coefficient for the entire machine, defined by

$$C_d = \frac{D}{qS}$$

D being the total drag, and S the wing area.

Air Travel with Special Reference to the Helicopter

By Major F. M. Green

Lecture delivered before the Royal Aeronautical Society of Great Britain

A striking development of the present century has been the use of air travel. A new method of going from place to place has come into use which is quicker than any former means. It is only since the war that definite air services have been available to the general public, and in consequence it is only right to believe that its development is in an early and crude state. At the present moment, although there are a number of types of aircraft engaged in this work, they are all similar in principle. It is suggested from time to time that we are possibly working on wrong lines and that air travel can be carried out more effectively using machines of quite other types. The suggested alternatives to the present aeroplane are airships and another form of heavier-than-air craft generally called the "helicopter" or direct lift machine. It is not proposed in this paper to discuss the relative merits of the aeroplane and the airship, but to state some of the outstanding disadvantages of the types of aeroplane now in use and to consider whether the "helicopter" offers a hopeful solution.

Objects of Air Travel

The usual object of air travel is to go from place to place quicker than is possible by any other means. Apart altogether from its greater speed, the aeroplane saves time by travelling more directly from point to point, and by avoiding changing for sea journeys. Nevertheless, the aeroplane must be able to maintain a high speed through the air in order to make effective progress against adverse winds. Experience has shown that the slowest cruising speed that is practicable for most routes exceeds 80 miles an hour. If the route chosen is likely to be fairly free from high winds and if the existing methods of travel are very slow, a slower speed might be useful. In a general way, however, the speed must be high to make it worth while using a method of travel which for some time to come must remain expensive.

Safety

Let us agree that it is useless to run an air service with machines with a cruising speed below 80 miles an hour; we may next consider what are the desirable attributes of a machine suitable for air travel. I think that safety must be the most important attribute of any aircraft. Later on we shall consider the question of cost of running, but it cannot be doubted, even if we neglect other considerations, that an aeroplane which is not reasonably free from chances of accident is not likely to be economical in service.

Reliability

Assuming that we have an aircraft of sufficient speed and safety, the next requirement is that, when a start is made, the passenger shall be reasonably certain of reaching his destination. The value of speed disappears very rapidly if, in more than a very small percentage of cases, the journey has to be finished by other means, or if a long stoppage has to be made en route. It has been said that air travel is either the quickest or the slowest means of travel—the quickest when everything goes right and the slowest if anything goes wrong.

Closely allied to the certainty of arriving at one's destination is regularity, for a transport service is of little use unless it can be trusted to operate at regular intervals.

There must also be a certain degree of comfort, or perhaps it is better to say a minimum degree of discomfort, otherwise the number of passengers likely to use air travel must be limited.

It is scarcely possible to live in figures the actual values of the requirements mentioned, though it is clear that if we are to make air travel into an ordinary commercial undertaking we must use aircraft in which the chance of accident to a passenger is no greater than the risk by train, motor-car or boat, while the time for the journey must be less than the best achieved by any combination of these means of travel. Regularity, reliability and comfort must approach the standard of the train.

The advantages of increased speed will encourage a proportion of the ordinary travelling public to pay a higher fare which will almost certainly be needed for a number of years. How much extra they will pay must depend upon the extent to which the service possesses the qualities mentioned. In my opinion, it is unwise to concentrate entirely on reducing the cost of running the service; rather we should endeavour to encourage passenger traffic by increasing the safety, speed, regularity and reliability of the service.

If we agree with the foregoing views our attention may be chiefly directed to safety combined with a certain minimum speed, and it is chiefly from these two aspects that the present-day aeroplane and its possible developments will be considered. I know of no example of a helicopter or direct lift machine which has achieved the smallest measure of success as a means of air travel, so that the comparison between the advantages of the two types is difficult. An attempt will be made to see what chance the helicopter has of becoming a rival to the aeroplane, and in order to do this we must touch on the first principles of mechanical flight. I do not propose to go deeply into the matter in a scientific way, as the experimental work on the helicopter is limited.

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First Principles

Heavier-than-air machines obtain their support from the air by giving to it a downward velocity. The momentum developed downwards of the air per second is a direct measure of the lift obtained. This applies to both aeroplane and helicopter. With the aeroplane the air is driven downwards by means of planes of suitable shape which are drawn through the air by the reaction of an airscrew. It may be said that the name airscrew is misleading, for an airscrew develops its tractive force not by screwing its way through the air (as the name seems to imply), but by projecting air backwards. Here again the reaction of the airscrew can be measured in terms of the momentum in the air displaced per second.

In the case of the helicopter the machine is sustained by projecting air downwards by means of wings or airscrews revolving in a plane which is more or less horizontal. The mechanism for obtaining support in the two cases is thus similar, but there is the wide difference that whereas the aeroplane uses the velocity of its lifting surfaces to carry it directly towards its destination, the helicopter planes or propeller blades, whichever you like to call them, have their main motion round a centre which is either fixed relative to the air or requires additional energy to move it. Diagram 1 shows this graphically—in the one case the planes of the aeroplane move from A to B in a straight line; in another they travel along a tortuous path. The energy required is roughly proportional to the length of the line joining A and B, hence it can be seen that the helicopter is at a very serious disadvantage.

Power Used for Snpport

The planes of a type commonly used in present-day aircraft have a ratio of lift to drag of about 15 to 1 when flying at their usual cruising speed. At 80 miles an hour in air of normal density we find that each effective horse-power spent on the planes alone corresponds to resistance of 4.7 lbs. and thus enables a weight of 71 lbs. to be supported. Taking a propeller efficiency of 75 per cent.—a figure usually obtained in practice—the weight supported per engine brake horse-power is 53 lbs. If we increase the speed of the aeroplane and use smaller planes, keeping the lift-drag ratio constant, the horse-power expended in flight will increase in direct proportion to the increased speed. This does not mean that as far as the planes are concerned more energy or more fuel will be used in travelling a given distance, but it does mean that the engine horse-power must be greater.

In the case of the helicopter it is generally understood that it is not possible to construct a direct lift airscrew that can lift nearly as much as 53 lbs. per horse-power, and if it were possible to do so the weight of the revolving planes themselves would be likely to exceed the weight lifted. The reason for this is simple—the support from the lifting screw is obtained by virtue of the downward momentum of the air in the slipstream. The air has a certain kinetic energy imparted to it which is entirely lost as far as the flying machine is concerned. The kinetic energy is proportional to the square of the velocity of the air in the slipstream, and it may be shown that to achieve a lift of 53 lbs./horse-power implies that the downward velocity must nowhere exceed 21ft./sec., and would in practice need to be less than this. This means that an airscrew to lift 1000 lbs. must have a diameter of between 30ft. and 40ft., which is scarcely practicable.

This calculation is quite elementary, and is given below.

Lift of helicopter=mass of air dealt with per second×downward velocity imparted $=Mv$.

Horse-power=kinetic energy lost per sec./550$=Mv^2/2\times550$ minimum.

$\therefore$Lift/H.P.$=Mv/Mv^2/1100=1100/v$

M is probably not greater than ρvA where A="disc area" of helicopter.

$\therefore$ Lift$/A = Mv/A = \rho v^2$, $\rho = .00237$.

If $W =$ weight of helicopter,

$$v = 1100/W/\text{H.P.}$$

$$\therefore W/A = .0023 \text{ x } (1100)^2/W/\text{H.P.})^2$$

$$\therefore \text{for } W = 1000$$

$d = .67\, W/$H.P. where $d =$ diameter of helicopter in feet.

and for a lift of 53 lbs./H.P. $d = 35$ feet minimum.

Power Required for Flight

In order to bring the size of lifting screw to a reasonable figure we must increase the downward velocity of the air and consequently the lift in lbs./horse-power must be less. It seems, therefore, that the power required for keeping the aircraft in flight is likely to be much greater in the helicopter than in the aeroplane (see Fig. 2). The resistance of the body, landing gear, and controlling organs of the helicopter is not likely to be less than that of the aeroplane, and we may assume it to be the same. There is, however, an additional resistance due to the framework, driving mechanism and so forth of the revolving propeller blades which is likely to be greater than the resistance of the structure and wiring of the conventional aeroplane.

The effectiveness of the lifting screw will be seriously disturbed by any forward motion imparted to the helicopter, for it will mean that at one point of its rotation the propeller blade will have an additional velocity imparted to it by the forward motion of the whole machine, while at another this speed will be reduced by an equal amount. It has been proposed by many inventors to make the angle of the blades vary throughout each revolution. This, however, involves additional mechanism, and the construction of it is scarcely likely to be simple or light. In any case there will be an additional resistance to be added to the whole resistance due to the movement of the revolving propellers through the air.

From the foregoing reasons I am convinced that the power expended in flight in a helicopter, flying at speeds found to be useful for aeroplanes, will be very much greater than for the aeroplane, and I believe that, apart from all other disadvantages, this fact alone will render the machine quite impossible for passenger carrying, at any rate until engines of much less weight per horse-power and materials with much greater specific strength are available. With present-day materials it is my opinion that it is extremely unlikely that it will be possible to make a direct lift machine carrying any useful load which will be able to fly as fast as 80 miles per hour, which is the slowest cruising speed that makes flying worth while in most cases.

Safe Landing

If the conclusions of the last paragraph are correct, it seems that as a means of air travel the helicopter has little or no future, and the fact that it may be possible to rise and land in confined spaces is of little value if the ability to fly from place to place at a reasonable speed is absent. In itself, the advantage of a vertical rise and fall is unlikely to be as great as might be supposed. The difficulty of affecting a landing of a direct lift machine in a wind is certain to be great. In the ordinary aeroplane the presence of a wind helps rather than hinders matters both in getting off and alighting. The case of the helicopter is worse than that of the airship, where considerable skill is necessary to effect safe landings in a high wind.

The idea of being able to lower your flying machine to the ground by the careful working of the throttle is a pleasing one, and at first sight it seems vastly to be preferred to the aeroplane method of approaching the ground with a forward speed of 50, 60 or more miles an hour. The fact remains, however, that aeroplane pilots do not find much difficulty in landing at these speeds so long as they are not forced to alight in unexpected places. The usual reason for forced landings is, of course, the failure of the motive power, and it will be interesting to see how the helicopter compares with the aeroplane in this emergency. The aeroplane method is to glide down to the ground at a speed somewhat above the stalling speed and to use the kinetic energy of the machine to level up and fly parallel to the ground for the last few moments before alighting. So long as there is room, this method presents no difficulties. In the case of engine failure in the helicopter the situation is rather different. Neglecting all difficulties of stability and assuming that the helicopter will keep more or less on an even keel, the whole machine will descend vertically in relation to the air, and its fall will be checked chiefly by the resistance of the supporting propellers. When the engine stops the propellers will either, after stopping, be driven round in the opposite direction or they may have their pitch reversed and travel in the same direction. The terminal velocity of the whole machine unfortunately must be high as the propellers do not offer very much more resistance when spinning than when stopped.

A reference to the experiments on the resistance of an airscrew on an aeroplane will show that the increase of resistance is only of the order of 10 per cent. when it is spinning at the velocity which gives the maximum resistance, as against when it is stopped. It is possible that a specially-designed screw would have a somewhat higher resistance than this, but there seems no reason to suppose that much can be gained. The helicopter, therefore, if unchecked, will strike the ground much faster than is convenient or can be readily dealt with by even an elaborate form of shock-absorbing gear. In addition, the whole machine will be moving relative to the ground at or nearly the velocity of the wind.

There is only one means of checking the fall of the machine known to me other than by the use of parachutes. The method is similar to that used by the aeroplane pilot—the supporting propellers will be revolving at a fair speed and will have in consequence a kinetic energy in virtue of their rotation. If at the last moment the propeller blades are reversed in angle, then their kinetic energy can be used to check the fall much in the same way as is done on the aeroplane. Whether this can be considered a feasible method or not is a matter of opinion, but it is the only method which I can suggest in case of engine failure on the direct lift machine. In any case, the results with forced land-

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ings are likely to be serious, for even if the rate of fall is checked there is sure to be some forward velocity due to the wind.

Landing in Fog

Landing in fog when it is not possible to see the aerodrome, the helicopter machine certainly does appear to possess its chief advantage. On foggy days there is usually little or no wind, and it ought to be possible to allow the helicopter to descend vertically at a sufficiently slow rate to avoid serious shock, even if the ground is completely invisible. We have as yet devised no safe method of landing aeroplanes in fogs, and although there is no reason to suppose we shall not eventually manage this, it is likely to be a difficult matter and will require a great deal of organization. As is known, the usual method of landing an aeroplane is to arrange its flight path so that it approaches the ground at as small an angle as possible. The aeroplane is flown at a speed exceeding the stalling speed, and either the throttle is opened slightly near the ground or else the angle of the planes is increased and the kinetic energy of the whole machine is used to supply the power.

It is generally assumed that if the angle of an aeroplane is increased so that it flies above its stalling angle, disaster is almost certain unless there is room to dive the machine and to regain sufficient speed to fly below the stalling angle. On aeroplanes as usually made, this is to a large extent true. The controls are insufficient to enable the pilot to manage the aeroplane when flying at an angle above the stalling angle. It is as well to mention that by the stalling angle is meant that angle at which the planes exercise their maximum lift coefficient, and when any increase in angle will not increase and may decrease the total lift coefficient. There appears no reason why it should not be possible to fly at angles much above the stalling angle. This subject has been the matter of research during the past year, and it has been found possible to fly an aeroplane at angles of incidence vastly greater than the stalling angle. It seems not unlikely that in the future it will be a safe manœuvre to glide an aeroplane at an angle of incidence of as much as 45 degrees, and still maintain control. The drag of the planes will be very large, and the path of the aeroplane will be about 45 degrees to the horizontal; consequently the fuselage of the aeroplane will remain nearly horizontal. In the case of a forced landing, or a landing in the fog, it might even be possible to bring an aeroplane down to the ground at an angle of 45 degrees, in which case the forward speed will be so much reduced that the aeroplane will run a very small distance after landing; also owing to the steep angle the errors of judging distance on the ground will be very much smaller. If the engine has not broken down it will probably be possible to straighten up the machine by means of the engine and a more or less normal landing. If the engine has broken down, or if it is impossible to see the ground, then it will be necessary to provide a landing gear designed to absorb a much bigger shock than is now customary. In any case, it is almost certain that the vertical velocity on landing will be considerably lower than will be possible with an helicopter machine with the engine stopped.

Stability

Another aspect of safety is the question of stability. It is, of course, possible to make an ordinary aeroplane stable in flight, and so long as the pilot is not undertaking any severe manœuvre, such as is sometimes made necessary by engine failure, the risk of accident from loss of stability is unimportant. The stability of a direct lift machine has, I believe, never been worked out numerically. It will certainly be a matter of considerable complication, and it may be anticipated that the structural design to meet the various forces that may occur on the direct lift machine due to sudden manœuvre will vastly increase the difficulty of designing what in any case must be a somewhat complicated mechanism.

Structural Safety

From the point of view of structural safety the helicopter is likely to present grave difficulties. The aeroplane depends for its support upon a system of planes which, except for small movements of the control surfaces, are fixed. In the helicopter the equivalent of the plane structure is dependent upon a number of bearings and working joints which will certainly increase the difficulty of making a safe structure that is reasonably light.

Conclusions

The brief discussion of the problems contained in this paper is meant to represent the argument which occurred to me when considering whether or not it was worth attempting the design of a direct lift machine. It is perfectly true that there are many considerations which would prevent a private constructor starting on such an undertaking which would not, and should not, influence the minds of those directing the official policy of a country in matters of aeronautics. This private constructor must be influenced by financial considerations to a greater extent than would be the Research Department of the Ministry. At the same time, there is only a limited amount of money that can be spent on research and experiment in aeronautics. We have been informed at the last two Air Conferences that experiments on full scale have been, and are being carried out by the Air Ministry, but we have not been supplied with any details either of the way in which the experiments are being made or of the results obtained, with the sole exception that a year ago we were informed that free flight had taken place. Recently there have been rumors of large prizes offered by the Government for any machine capable of doing certain performances, which include hovering. I do not know the precise arguments which led the Air Ministry to undertake work of this description, but for the reasons given in the former part of the paper it seems to be improbable that any useful result will be obtained unless we can make vast improvements in the technique of the production of power and the making of light structures; such advances would also improve the design and performance of the ordinary aeroplane.

It will no doubt be argued that there are peculiar advantages that might be gained in war from a machine capable of hovering, but if this is so it is suggested in all seriousness that a balloon or an airship is a far more promising method of obtaining the required result. It is likely to cost less and to be safer. The object of air travel is to get from place to place, and it seems highly unlikely that the helicopter type of machine will ever afford a useful means of doing this.

Art School Prize Contest on Model Airplane Trophy

B. H. Mulvihill, of Pittsburgh, vice-president of the National Aeronautic Association of U. S. A., has announced a prize competition for art schools of $100, $50 and $25 for the three best designs for a model airplane trophy for which boys will compete at the international airplane races in St. Louis in Ocotober. The Mulvihill trophy contest at St. Louis is the first of its kind ever held and will bring together the winners of elimination contests conducted all over the country. At St. Louis the flight of the model airplane will be for distance under official observation and regulation.

"This will be known as the National Aeronautic Association design contest," said Mr. Mulvihill, "and will be open to any student of sculpture in any accredited art school and to graduates since 1921. It has been suggested that in large cities there might be local contests under the auspices of the directors of the several schools and that the three best designs be then entered for the national judging, which will be done in Washington. The models will be in clay, of course, and the awards will be based on artistic excellence and appropriateness of the subject. They must be submitted by July 15.

"Model airplanes are proving not only good sport for boys and girls, but their construction by the young fliers themselves is teaching them the principles of the power airplane. The characteristic pose of a boy launching with his hands a tiny plane lends itself to an action design for a trophy that ought to develop some very interesting and beautiful subjects."

The judging for the final awards to the three winners will be held about August 1, at National Headquarters of the Association. when the names of the successful sculptors will be announced, and photographs of the three best models issued for publication.

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Proper Thought Adds Forty Miles To Speed

Four airplanes with about the same characteristics, same engines, same landing gear, same tails and one shows 40 miles better speed. Wing sections and reduction of areas of but slight effect on speed. Careful streamlining, encasing of fittings, efficient fuselage and radiator combination and suitable propeller comprise the secret of speed.

FLIGHT tests of four similar airplanes carried out at the Langley Field laboratory of the National Advisory Committee for Aeronautics to determine their relative performance with the same engine and the same air screw show:

1. A small change in wing section or wing area affects but slightly the performance.

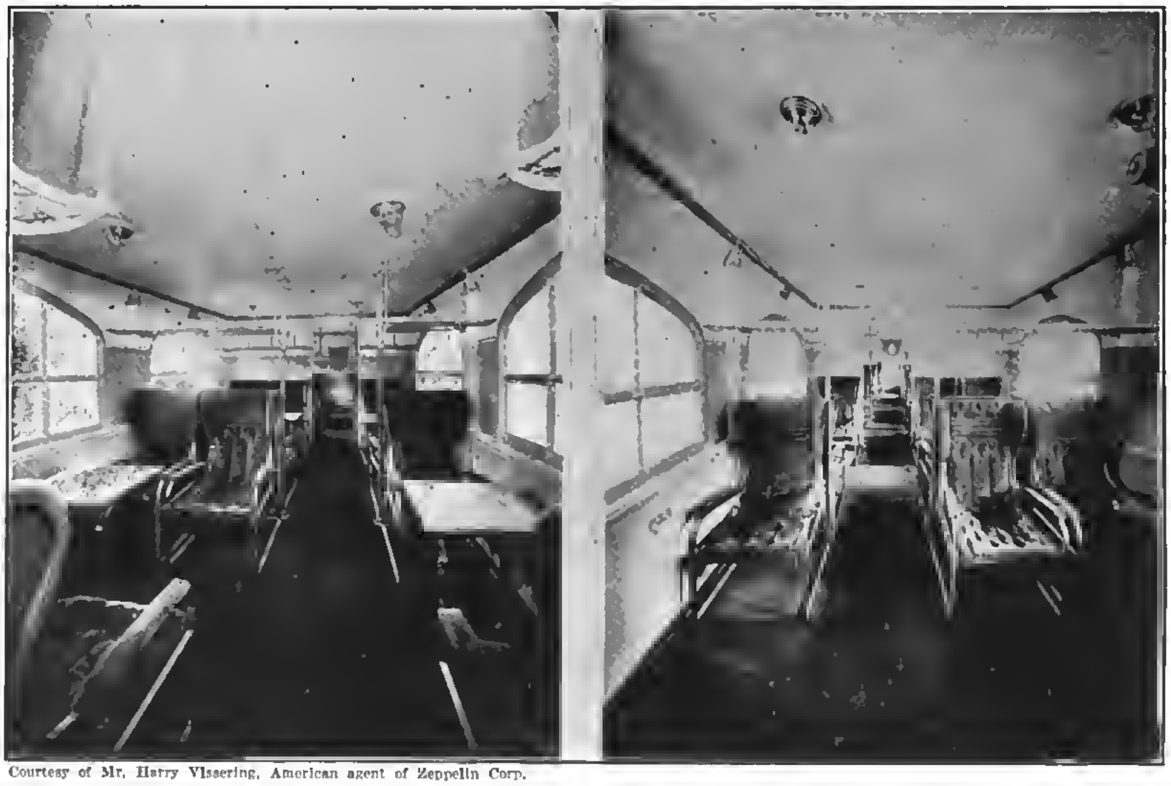
2. Changes in parts causing structural resistance have a very important effect.

The Committee has in commission three JN4hs, all varying somewhat in the type of supporting surface used, and a VE7 with the same engine and about the same weight as the others but much more carefully streamlined. In flying these airplanes it has been often observed that there is very little difference in the performance of the JN4hs whereas the VE7 shows a distinctly higher performance It was decided to carry out the seven tests listed in the chart. The two JN4hs were similar in every way. The third JN4h had 50 feet less area and the king post and overhang wires were removed. The tabulation shows the characteristics and conditions and results in speed.

All the flights were made at constant height, 2,000 feet. All speeds were corrected for density and correction was made for air speed head error. The chronometric tachometers were carefully checked and the readings are correct to within + 10 r. p. m. All the air speed instruments were calibrated and are precise to within + 1 mile per hour.

The results of the tests were plotted in the report made by F. H. Norton and W. G. Brown. Engine speeds and airplane air speeds were lotted against each other. For the three "Jenneys" with the JN air screw the curves were fairly close together, with the standard airplane quite markedly the lowest. The application of the VE7 air screw to the No. 1 JN4h gave a considerable increase in the propulsive efficiency, especially at lower speeds.

Airplane No. 4 with the JN air screw stands out distinctly from the other airplanes with an air speed for a given r. p. m. of 20-25 m. p. h. higher. This machine can fly level at slightly over 1000 r. p. m. whereas the others require at least 1200, a striking difference. When the VE7 air screw is installed on airplane No. 4, the Vought, a somewhat higher speed is obtained for the same r. p. m. up to 1,550, the limiting speed when the JN air screw is installed on airplane No. 4, never ever allows the engine to turn up 1,700 r.p.m., giving an air speed of 126 m. p. h. 40 miles faster than the maximum speed of the others. Another run was tried on the VE7 with SE5 air screw which allowed the engine to turn up to 2,100, but a speed of only 122 m. p. h. was attained.



Courtesy of Mr. Harry Vissering, American agent of Zeppelin Corp.

Airships, helium filled, not only guarantee safety; but they may be made the most comfortable aircraft known. These are passenger lounging rooms in the Zeppelin Bodensee, now in Italian hands.

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Why There Is A Need For Industrial Standardization

By Albert W. Whitney

Chairman, American Engineering Standards Committee

THE need for standardization arises out of two situations. In the development of a new project the first in the field are the inventors. Of necessity they have to try out a large number of ideas; many of these prove to be useless and of those that are valuable some are better than others. Inventors are not the people to clear up the confusion in which they have left things; that is not their business, but somebody must make a selection among this confusing and unnecessary variety.

In addition the field gets unnecessarily littered up by the casual development of the business, largely through competitive influence exerted through the sales organization.

It is the job of the standardizer to take care of both of these situations; he must out of this variety select those things and those ideas that are best worth keeping.

This has two effects. It produces greater efficiency; by a reduction of the multiplicity of processes and products it allows for concentration on those that are worth while; the resulting increase in efficiency is effective all along the line, not merely in manufacturing but in selling and in buying. This is the common view of standardization and is so well understood that I need not dwell on it further.

But in addition to this, standardization does something else that is equally important. It frees the human spirit for making further advances. If there were no standardization the creators of ideas would have to be continually re-creating and would have no time for further advance. Whenever a bolt or an I-beam or a generator was needed it would have to be a matter for design. Standardization allows such needs to be taken care of through routine process and the creative spirit is relieved for fresh first-hand adventures.

Standardization instead of killing invention and initiative is the very basis upon which it rests. It is standardization that makes further invention possible.

I have had something to do with the safety movement and the situation in that field is somewhat the same. I could not feel happy at first for safety seemed to kill adventure. Its inhibitions seemed to take the snap and sparkle out of life. I could not be contented until I had thought the thing through and realized that the real aim of the safety movement was substitution and not subtraction. It substituted a real adventure for a poor adventure. It is a very stupid adventure to get ground up in a lathe or to be mangled under the wheels of a street car. The safety movement saves life for the express purpose of having a real adventure. The safety movement, therefore, is not negative but distinctly positive. I have something to do just now with getting safety education in the schools; I should go into this work with much less interest if it were not that it had this larger duty of increasing the values of life and of raising the standard of life to that of a real adventure.

Similarly I could not feel happy in the standardization movement until I came to realize that it did not produce stagnation but rather created a basis upon which to build fresh adventures in creative development.

There is a very good analogy in the development of the body and mind. To a remarkable extent both the body and mind are standardized. If our bodies were not essentially alike we could have no surgery or medicine, for a surgeon in operating for appendicitis might find a heart when he was looking for an appendix. If our minds were not essentially alike we could bave no organized education; education would have to be an individual process.

The similarity of our bodies and minds affords the underlying basis ou which we can construct social life and civilization and yet it is the departure from the standard which gives the touch of individuality and which not only gives the charm to our social contacts but which makes the cutting edge of progress.

There is a danger in standardization, the danger of too early standardization and too drastic standardization but there is a danger connected with the use of any powerful instrument. The problem of civilization and progress is to a very great extent a problem in the wise use of standardization.

WORLD PROGRESS in AERONAUTICS

SOVIET Russia has begun the development of a great commercial military aircraft program and occupies an important position in the international race for supremacy in the air, according to the Aeronautical Chamber of Commerce, which has made public its annual survey of aviation throughout the world.

The report, covering flying activities in 58 countries, finds France the leader of all nations in both commercial and military aviation, and still working on heavy programs. The survey of the Russian activity, however, is of unusual interest.

"Russia is using German, French and Dutch airplanes. Special aviation schools have been established at Toula, Moscow, Smolensk, Kharkow, Pola, Ekaterineslaw, Mokilaw and Petrograd. The Council of Commissaries has voted to obtain 300 new airplanes for the Red Army. It is reported authoritatively that 100 planes have been brought from Italy. In four cities the government has established domestic aircraft factories. The program for the year is to fully equip 70 fighting squadrons.

"In all, the Soviet government's program calls for 5,000 airplanes with spare parts. With the assistance of German aeronautical experts plans have been made for exploiting vast territories. Great trunk lines have been charted. It is proposed to have in operation by 1926 many thousands of aircraft. German pilots are expected to join the comparatively few Russian aviators on the commercial lines.

"France, in developing the colonial air defenses, operates a passenger and mail service three times weekly between Algiers and Biskra, another between Oran, in Western Algeria and Casablanca on the west coast of Morocco, twice weekly. During the first eleven months in 1922 the French built 3,300 airplanes for military and commercial purposes, and let orders for 1,200 additional machines. The French program for 1923 calls for 220 air squadrons, with ten machines to a squadron, or 2,200 planes with 100 per cent reserves. French air appropriations were greater in 1922 than all nations combined, aggregating $84,591,755.

"In 1922 all the French air lines operating to Africa, London, Brussels, Amsterdam, Tunis, Constantinople, Genoa and other points, in all, 14 distinct air lines, flew a total of 2,146,234 miles, carried 14,397 passengers, 1,165,216 pounds of parcels and 90,580 pounds of mail. It is planned to link all possessions from Indo-China to Guiana, through Africa and the Republic within two years. Aviation is being taught in the schools and colleges and a completely equipped French mission is making a tour of the world, and giving demonstrations in Europe, Asia, Africa and South America.

"Great Britain has centralized her aviation in the Air Ministry. Her Royal Air Force numbers 3,000 officers and 26,500 enlisted men. There are 33 squadrons—21 of them in the colonies, the Near East and India, and 12 in the British Isles. The Air Ministry employes 4,382

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civilians. Approximately $54,000-000 is being spent for aviation, including $11,000,000 for construction and $2,000,000 for civilian aviation. The air estimates for the next fiscal year approximate $94,000,000.

"In Italy Premier Mussolini recently placed the air service on a par with the army and navy. Several new squadrons are being organized, and many projects for operating semi-Governmental airship service have been begun. Approximately $3,000,000 is being spent for new construction.

"In 1922 Japan appropriated $11,-304,873 for naval aviation, of which $1,586,924 is being spent for construction of new planes. About $16,000,000 is being spent on military aviation, a fourth of it for new equipment. The government is providing subsidies and liberal rewards for civilian aviation.

"German aviation, though handicapped by the treaty terms, is progressing. German engineers are active, and manufacturers of aircraft are building machines in Switzerland, Italy and Russia, and possibly in Finland and the Scandinavian countries. In addition they are most active in Asia, Soviet Russia and certain South American republics. The German Government in 1922 appropriated 22,000,000 marks in subsidies for German commercial air lines. The Hamburg-American and North German Lloyd lines are interested in several aerial projects, including both airplanes and airships. There are five other aerial operating companies. For many months they have been operating between Germany, Russia and the Baltic states, and Switzerland.

"Other countries which have relatively extensive aerial programs this year include Argentina, Australia, Belgium, Bolivia, Brazil, Canada (and all other countries in the British Commonwealth) Chile, China, Columbia, Cuba, Denmark, Holland, Ecuador, Esthonia, Finland, Honduras, Hungary, Latvia, Lithuania, Mexico, Norway, Paraguay, Peru, Poland, Portugal, Rumania, Russia, Siam, Spain, Sweden, Switzerland, Turkey, Uruguay and Venezuela.

"Mexico is spending $1,495,500 on her air service, and while the government has purchased a number of planes in the United States, it is planned to buy 200 machines in Europe during the year.

"Spain learned a lesson in the Moroccan campaign, and since then has provided a market for all European constructors. In addition to active expansion of military aviation, daily air services are being operated. A trans-Atlantic airship service is projected to be supported financially by the government."

© Official photograph U. S. Navy.

Ready For Business

Squadron of Navy Combat Planes engaged in Maneuvers over the Naval Air Station at San Diego, Cal.

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An Optical Altitude Indicator for Night Landing*

By John A. C. Warner, Bureau of Standards

THAT practical commercial aviation has come to stay must be admitted by even the most skeptical. The rapid advance which the past few years have witnessed is unmistakably the forerunner of greater activity in this comparatively new field of communication and transportation. It is at once evident, however, that the greatest benefit cannot be derived from the use of aircraft as commercial carriers unless their operation can be extended over the full twenty-four hour day; for their inactivity during the hours of darkness robs them to a great extent of their advantage over the systems of ground transportation.

For this reason the problem of flying at night and under other conditions of low visibility is now demanding the attention of many aeronautical experts. We must equip our airways and aircraft with suitable means for surmounting the obstacles offered by these adverse conditions. This of course involves the installation of markers and beacons to clearly define the routes and fields, and also the equipping of aircraft with suitable instruments for navigation and landing. One of the most ingenious of the devices intended for use in night landing, especially emergency landing, is a very simple optical instrument known as the Jenkins night altitude indicator.

Referring to fig. 1, we note three projectors: A, B, and C, each of which is equipped with an incandescent lamp properly mounted at the upper extremity to project a beam of light downward through the tube to the ground or water upon which a landing is to be made. Two of these projectors: B and C, are attached rigidly and parallel to each other to the side of the aircraft, while the third, A, is made rotatable (upon rails D and E) through a certain angle in a plane parallel to the fore-and-aft-axis of the ship. Motion of A is brought about by the aviator who manipulates a handwheel operating through a pinion mating with rack F.

Projectors B and C are each equipped with an object screen which provides a characteristic image on the landing surface; as shown in Figs. 2 and 3, a rectangular bar is projected by B and two blunt arrowheads by C. The ground image from A is the altitude figure representing the particular altitude for which the projector is set.

In determining the altitude of the aircraft the pilot simply turns the wheel attached to the pinion mating with rack F until the light-beam from A intersects that from C at the landing surface. As A rotates, a toothed metal disc G attached to A and extending through the walls of the projector tube into the light-beam is caused to rotate in a definite manner by virtue of the action between the teeth of G and those of the fixed rack with which they engage. The rotating disc acts as a rotatable object screen, for it is pierced by openings in the form of the altitude numerals corresponding to the particular setting of the projector. Thus it is that the image seen upon the landing surface between the arrowheads projected by C is that of the altitude numerals cut in G, through which the light passes.

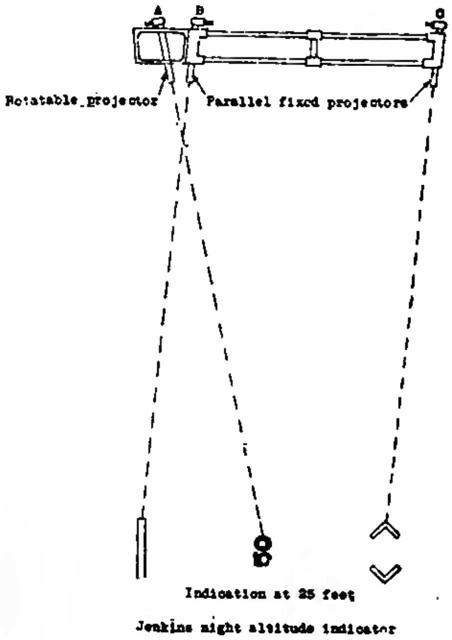

Fig. 2

The altitude may also be observed on the transparent scale H, for an opening in the case containing the illuminating element of A allows a beam of light to fall upon the scale graduation which corresponds to the particular setting of the projector at which the ground images are seen to meet. The intersecting beams (from A and C) form two sides of a triangle whose altitude, determined with the instrument, is also that of the aircraft above the landing surface.

Inasmuch as 50 feet is the lowest direct indication of altitude for the instrument described, the illuminated bar image projected by the fixed

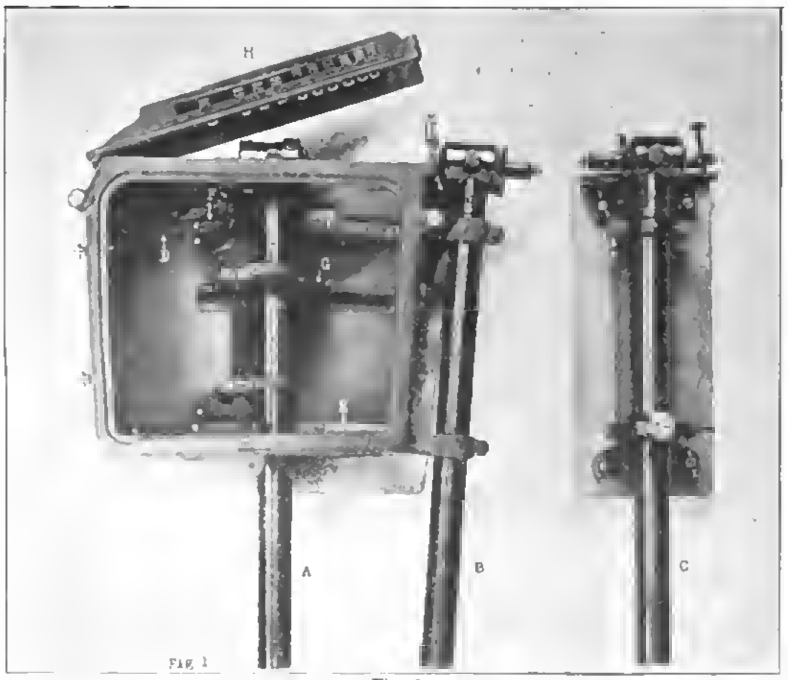

Fig 1

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source B is employed in estimating altitudes of less than 50 feet. It will be seen that as the aircraft approaches the ground with all three projectors stationary, the numeral "50" will move from the arrowheads toward the bar image. The prevailing altitude is then estimated by observing the position of the altitude image with respect to the bar and arrowheads. For example, an altitude of 25 feet would be indicated when the numerals were observed midway between the other two images as shown by fig. 2. The maximum direct indication of the instrument is 500 feet (see Fig. 3).

The night altitude indicator described has been used in Great Britain.

Tests of the instrument conducted in this country have shown satisfactory results. *

The Germans have developed several types very similar in principle to the Jenkins' device. One of the most interesting of these involves the projection of a beam downward and forward from a light-source fixed to the tail of the aircraft. Diffusely reflected rays are in turn thrown upward from the landing surface and pass through an optical arrangement in the cockpit where the pilot may observe his altitude by noting the position of a spot of light against a transparent scale.

Indication at 500 feet

Ground imagee

of

Jenkine night altitude indicator.

Fig. 3.

Various possible modifications and improvements of the above instruments are readily apparent. For example, the Jenkins' indicator might be simplified by omitting the second projector (B) whose advantages are of doubtful importance; for at altitudes below 50 feet a pilot would generally prefer to watch the landing area ahead of him rather than to observe the ground images and estimate their relative positions.

Further simplification might be effected by having both projectors (A and C) fixed to the aircraft in definite positions. In this case the beams of light would intersect at the landing surface for only the one chosen altitude to which the arrangement had been adjusted. Other altitudes might be estimated by noting the separation of the images. For such purposes it would be desirable to have the projected images characteristic of their source; otherwise difficulty would arise in readily determining whether the forward or aft image was leading.

To the writer's knowledge no tests have been conducted in this country to determine the characteristics of the German adaptations as mentioned above. However, one might reasonably douht the feasibility under all conditions of using the diffusely reflected rays from a landing surface for other than direct observations.

*Technical Note No. 123 of N. A. C. A.
*Bureau of Standards tests conducted in flight and in the laboratory by A. H. Mears and J. B. Peterson.

The Costanzi Multimanograph

THE discussion of various methods for measuring the forces acting on the various members making up the structure of an airplane in flight has been going on during the last seven years. Various methods have been suggested and tried, a number of more or less empirical formulae have been developed and safety factors varying between 5 and 15 and even as high as 21 have been adopted in the design of modern aircraft.

In spite, however of carefully made static tests we have had a number of cases when aircraft have broken up in flight while making a turn or in the performance of acrobatic stunts. Under these conditions, quite evidently, the distribution and the magnitude of the dynamic load on wings and other parts of an airplane are quite different from those prevailing in sand loading and other static tests on the ground.

An instrument which would register the variation and the magnitude of the forces acting on various points of an airplane in flight under any flying conditions has been needed

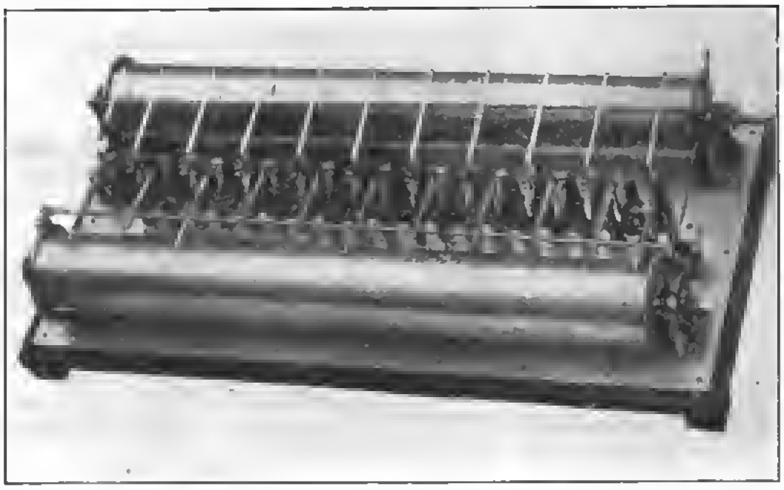

Fig. 1

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ever since flying was started. An instrument of this nature was developed by Col. G. Costanzi of the Italian Army, while he was the Directot of the Experimental Division of Aeronautics in Rome, Italy. Details of this instrument have never been published, and we are indehted to Col. Costanzi for being able to present to the readers of Aerial Age a description of this apparatus.

The principle on which the instrument was designed is very simple, and the instrument itself consists of a battery of twenty-one very sensitive manometric capsuls (fig. 1). Each one of these units has a diameter of 50 m.m.; the diaphragm is made of a special alloy .05 m.m. thick, undulated surface and is fixed to a wooden base through a support consisting of a tube through which the air is admitted. Rubber tubes attached at one end to one of the manometers and leading it to the other end, through the wings or through the body of the airplane to any desired spot on the wings, control planes, or tail of the airplane, allow the air pressure at various points of an airplane in flight to act upon the diaphragms of the twenty-one manometers.

The twenty-one manometers of the Costanzi Multimanograph, as the instrument is called, are arranged on two rows of ten and eleven manometric units respectively. The tubes of all units are all connected with a single faucet located in the cockpit in front of the pilot and which is designed so that when the instrument is not working all the manometers register the still air pressure at a convenient spot at the interior of the fuselage. When the instrument is put in operation, the twenty-one manometers start operating simultaneously at once.

Attached to the diaphragm of each manometer, a registering device reproduces graphically on two rotating cylinders the amplitude (conveniently amplified through a system of levers) of every axial displacement of the center of the diaphragm. In this way twenty-one records of the variation of air pressure in as many points of the aircraft are simultaneously obtained on the paper wrapped around the two cylinders mentioned above.

These two cylinders are 510 m.m. long, and make a complete rotation in two minutes, under the action of two cronometric electro magnetos and are automatically stopped when the registering devices of the manometers are lifted all at once from the cylinder and the Multimanograph is not working.

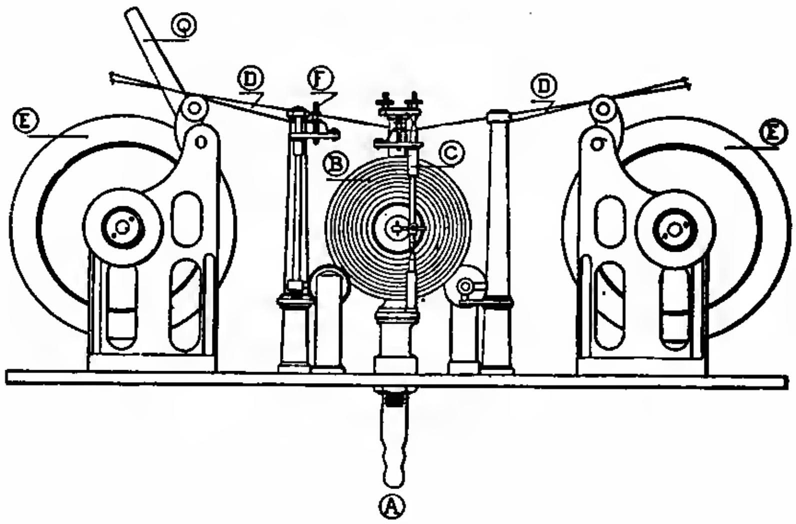
It is advisable to connect in so far as it is possible all the manometers in a row with those points where pressures are expected and the manometers of the other row with points where air depressions are to he measured.

Every manometer is perfectly balanced under the influence of the inertia forces acting upon its component parts in flight. The maximum air pressure or depression that can be registered by each manometer is equal to 25 m.m. of mercury.

The Costanzi Multigraph was built in 1919 and has since been tried on a S. V. A. airplane with very gratifying results. Due however, to the many changes which have taken place after the war in the ever changing organization of Italian aeronautical services, the tests have not been continued, in spite of the very satisfactory results obtained.

It is expected however that the new Italian government which seems to be willing to take aeronautics seriously will soon discover once more the Multimanograph which supplies a much needed instrument for obtaining some real information about the actual forces acting on an aircraft in flight.

This knowledge is sorely needed, if safety factors in airplane design are supposed to have a real meaning instead of the theoretical meaning that they have now.



Aerological Aid for Aviators

THE United States Weather Bureau is anxious—and so is every one else interested in seeing aviation, and aerostation when we get it, go forward with the greatest possible speed and with the full utilization of all the aids that are available—to have pilots of the country take full charge of its forecasts, warnings and information.

Service Now Furnishes Government Aviators

Every Army and Navy aircraft station has been thoroughly informed of the aid the Weather Bureau can give. All these stations have been supplied with maps showing the locations of existing Weather Bureau stations. Each of these stations is marked on the map by characteristic signs to indicate whether it has (1) facilities for surface observation only, (2) those capable of making surface and upper air observations by means of pilot balloons, (3) those having, in addition to pilot balloon observation, upper air observation with instrument-carrying kites and (4) those which are District Forecast Centers and prepared to give weather condi-

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tions and forecast for more extended areas than other stations.

In addition to these markings, certain stations are marked to indicate installations by the meteorological section of the Signal Corps of the Army, with pilot balloon observation. These in the main, are Army Air Service stations. Those of the Navy with similar features are also marked.

Around the location on the map of any one station there is drawn on the copy sent that station a large circle representing the territory within a radius of 300 miles. Each Army or Navy or other activity at the center of this circle is expected to cooperate with the Weather Bureau stations enclosed. Where the circle of another Army Air Service organization which is less than 600 miles away overlaps this circle a division is made as to the cooperation with the stations within the radius from both activities, and the Chief of Air Service makes the division and furnishes a list in a corner of the map of the Weather Bureau stations to be worked with.

Air Service pilots in these various areas have been instructed by the C. A. S. to make flying trips to the Bureau's stations, meet the personnel, study the possibilities and limitations of aerology and at the same time locate and inspect such landing fields as may be over-flown in the course of these visits. Weather Bureau officials are asked to lecture to the pilots.

Similar instructions have been given Navy personnel.

Air Service stations, when flying operations are carried on, are expected to call certan Weather Bureau offices at 9:30 a. m. and 9:30 p. m., eastern time to obtain information on the actual weather conditions prevailing at 8 a. m. and 8 p. m., eastern time, all over the country, which information is wired by the Weather Bureau to all its stations. Any Weather Bureau station will, upon receipt of a prepaid telegram from an Army or Navy flyer away from his station, requesting information as to prevailing and expected weather conditions in a particular section, furnish the information by prepaid wire in return, the Weather Bureau standing half the expense.

Service to the Public

The Weather Bureau will furnish any flying organization or individual pilot similar weather information by telegram collect upon receipt of prepaid telegram.

Flying forecasts for the fourteen aeronautic forecast zones (fig. 1) of the United States, covering the country east of the Mississippi River, are broadcasted from the Navy radio station at Arlington, Va., at 10:30 a. m. and 10 p. m., eastern time. The night forecast covers weather conditions in the zone until noon of the following day; the morning forecast covers weather conditions in the various zones from noon until midnight of the same day.

The Washington Post and the Washington Herald publish each morning a special forecast furnished them by the Weather Bureau for routes from Washington, D. C., to Norfolk, Va., and from Washington to New York and from Washington to Dayton, Ohio.

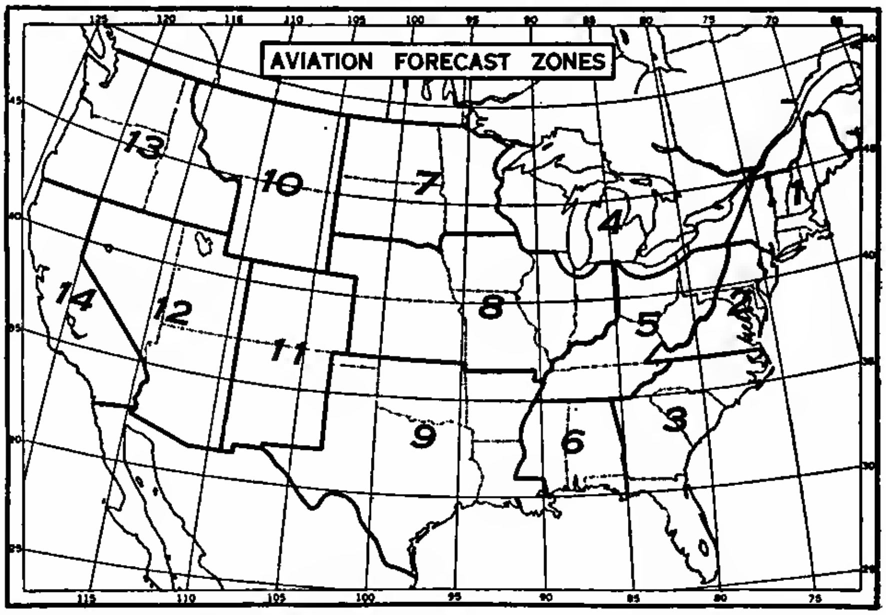
Here is an opportunity for aero clubs in various cities where there is considerable flying to obtain the support and interest of the local newspapers.

The six aeronautic forecast zones are illustrated in Fig 1.

Table I is a list of Weather Bureau stations arranged by the 600-mile circle system of the Army Air Service. These are numbered to indicate their character, as outlined in the second paragraph of this article.

In addition to these Weather Bureau stations arranged under the Army Air Service system, there are given, in Table II, a complete list of Weather Bureau stations prepared to furnish weather data.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.



Forecasts of weather conditions and of wind at surface and aloft are issued twice daily for the benefit of aviators. They are made at 9:30 a. m. and 9:30 p. m. (75th meridian time), and cover a period of 12 hours, beginning at noon and midnight, respectively.

The forecasts for the various zones are prepared and issued from forecast centers of the Weather Bureau as follows:
Washington, D. C.: Zones 1, 2, 3, 5, 6, 9, and 11.
Chicago, Ill.: Zones 4, 7, 8, and 10.
San Francisco, Calif.: Zones 12, 13, and 14.

List Weather Bureau Stations

Abilene, Tex.
Albany, N. Y.
Alpena, Mich.
Amarillo, Tex.
Anniston, Ala.
Apalachicola, Fla.
Asheville, N. C.
Atlanta, Ga.*
Atlantic City, N. J.
Augusta, Ga.
Baker, Oreg.
Baltimore, Md.*
Binghamton, N. Y.
Birmingham, Ala.
Bismarck, N. Dak.*
Block Island, R. I.
Boise, Idaho *
Boston, Mass.*
3-Broken Arrow, Okla.†
Brownsville, Tex.
Buffalo, N. Y.
2-Burlington, Vt.
Cairo, Ill.
Canton, N. Y.
Cape Henry, Va.
Cape May, N. J.
Charles City, Iowa.
Charleston, S. C.
Charlotte, N. C.
Chattanooga, Tenn.
Cheyenne, Wyo.*
4-*Chicago, Ill.*
Cincinnati, Ohio
Cleveland, Ohio.
Columbia, Mo.*
Columbia, S. C.*
Columbus, Ohio.*
Concord, N. H.
Concordia, Kans.
Corpus Christi, Tex.
Dallas, Tex.
Davenport, Iowa.
Dayton, Ohio.
Del Rio, Tex.
2, 4—*Denver, Colo.**
Des Moines, Iowa.*
Detroit, Mich.
Devils Lake, N. D.
Mobile, Ala.
Modena, Utah.
Montgomery, Ala.*
Moorhead, Minn.
Nantucket, Mass.
Nashville, Tenn.*
New Haven, Conn.
4-*New Orleans, La.**
New York, N. Y.
Norfolk, Va.
Northfield, Vt.
North Head, Wash. (P. O. Ilwaco, Wash.)
North Platte, Nebr.
Oklahoma City, Okla.*
Omaha, Nebr.
Oswego, N. Y.
Palestine, Tex.
Parkersburg, W. Va.*
Pensacola, Fla.
Peoria, Ill.
Philadelphia, Pa.*
Phoenix, Ariz.*
Pierre, S. Dak.
Pittsburgh, Pa.
Pocatello, Idaho.
Point Reyes, Calif. (Through San Francisco Sta.)
Port Angeles, Wash.
Port Arthur, Tex.
Port Huron, Mich.
Portland, Me.
Portland, Oreg.*
Providence, R. I.
Pueblo, Colo.
Raleigh, N. C.*
Rapid City, S. Dak.
Reading, Pa.
Red Bluff, Calif.
Reno, Nev.*
Richmond, Va.
Rochester, N. Y.
Roseburg, Oreg.
Roswell, N. Mex.

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Dak.
Dodge City, Kans.
3-Drexel, Nebr.†
(P. O. Washington, Nebr.)
Dubuque, Iowa.
Due West, S. C.†
Duluth, Minn.

Eastport, Me.
Elkins, W. Va.
Ellendale, N. Dak.†
El Paso, Tex.
Erie, Pa.
Escanaba, Mich.
Eureka, Calif.
Evansville, Ind.

Fort Smith, Ark.
Fort Wayne, Ind.
Fort Worth, Tex.
Fresno, Calif.

Galveston, Tex.
Grand Haven, Mich.
Grand Junction, Colo.
Grand Rapids, Mich.
Green Bay, Wis.
Greenville, S. C.
3-Groesbeck, Tex.†

Hannibal, Mo.
Harrisburg, Pa.
Hartford, Conn.
Hatteras, N. C.
Havre, Mont.
Hawaiian Volcano Observatory. (P. O. Volcano House, Hawaii.)
Helena, Mont.*
Honolulu, Hawaii*
Houghton, Mich.
Houston, Tex.*
Huron, S. Dak.*

Independence, Calif.
Indianapolis, Ind.*
Iola, Kans.
2-Ithaca, N. Y.*

Jacksonville, Fla.*
Juneau, Alaska*
Kalispell, Mont.
Kansas City, Mo.
Keokuk, Iowa
Key West, Fla.
Knoxville, Tenn.

La Crosse, Wis.
Lander, Wyo.
2-Lansing, Mich.*
Lewiston, Idaho.
Lexington, Ky.
Lincoln, Nebr.*
Little Rock, Ark.*
Los Angeles, Calif.
Louisville, Ky.*
Ludington, Mich.
Lynchburg, Va.

Macon, Ga.
2-Madison, Wis.
Manteo, N. C.
Marquette, Mich.
Memphis, Tenn.
Meridian, Miss.
Miami, Fla.
Miles City, Mont.
Milwaukee, Wis.*
Minneapolis, Minn.*
3-Royal Center, Ind.†
Sacramento, Calif.
Saginaw, Mich.
St. Joseph, Mo.
St. Louis, Mo.
St. Paul, Minn.
Salt Lake City, Utah.*
San Antonio, Tex.
San Diego, Calif.
Sand Key, Fla. (Through Key West Sta.)
Sandusky, Ohio.
Sandy Hook, N. J. (P. O. Fort Hancock, N. J.)
2, 4—*San Francisco, Calif.**
San Jose, Calif.
San Juan, Porto Rico, W. I.*
San Luis Obispo, Calif.
Santa Fe, N. Mex.*
Sault Sainte Marie, Mich.
Savannah, Ga.
Scranton, Pa.
Seattle, Wash.*
Sheridan, Wyo.
Shreveport, La.
Sioux City, Iowa.
Spokane, Wash.
Springfield, Ill.*
Springfield, Mo.
Syracuse, N. Y.

Tacoma, Wash.
Tampa, Fla.
Tatoosh Island, Wash.
Taylor, Tex.
Terre Haute, Ind.
Thomasville, Ga.
Toledo, Ohio.
Tonopah, Nev.
Topeka, Kans.*
Trenton, N. J.*

Valentine, Nebr.
Vicksburg, Miss.*
Wagon Wheel Gap, Colo.‡ (Through Denver Sta.)
Walla Walla, Wash.
2, 4—*Washington, D. C.*
Wausau, Wis.
Wichita, Kans.
Williston, N. Dak.
Wilmington, N. C.
Winnemucca, Nev.
Wytheville, Va.

Yankton, S. Dak.
Yellowstone Park, Wyo.
Yuma, Ariz.

Repair Stations (Under supervision of Port Angeles, Wash.)
Clallam Bay, Wash.
Neah Bay, Wash.
Sekiou, Wash.§ (Through Port Angeles Sta.)
Twin, Wash.

Table I

McCook Field, Dayton, Ohio.
Dayton, Ohio.
Port Huron, Mich.
Saginaw, Mich.
2-Lansing, Mich.
Detroit, Mich.
Sandusky, Ohio.
Cincinnati, Ohio.
Columbus, Ohio.
Toledo, Ohio.
Cleveland, Ohio.
Parkersburg, W. Va.
Fort Wayne, Ind.

Bolling Field, Anacostia, D. C.
2-4 Washington, D. C.
Pittsburgh, Pa.
Elkins, W. Va.
Dahlgren, Va.

Rockwell Field, Coronado, Calif.
San Diego, Calif.
Phoenix, Ariz.
Yuma, Ariz.

Godman Field, Camp Knox, Ky.
Louisville, Ky.

Mather Field, Sacramento, Calif.
Sacramento, Calif.
Eureka, Calif.
Red Bluff, Calif.
Reno, Nev.
Winnemucca, Nev.

Ellington, Field, Houston, Tex.
Houston, Tex.
Dallas, Tex.
Forth Worth, Tex.
Palestine, Tex.
Groesbeck, Tex.
Galveston, Tex.
Port Arthur, Tex.
Shreveport, La.

Post Field, Fort Sill, Okla.
Oklahoma City, Okla.
Amarillo, Tex.
3-Broken Arrow, Okla.
Fort Smith, Ark.
Wichita, Kans.

Fort Riley, Kans.
Topeka, Kans.
2-4 Denver, Colo.
Pueblo, Colo.
Lexington, Ky.
Indianapolis, Ind.
Evansville, Ind.
Cairo, Ill.
Nashville, Tenn.
Knoxville, Tenn.

Pope Field, Camp Bragg, Fayetteville, N. C.
Raleigh, N. C.
Lynchburg, Va.
Wytheville, Va.
Charlotte, N. C.
Asheville, N. C.
Wilmington, N. C.
Columbia, S. C.
Charleston, S. C.

Aberdeen Proving Ground, Aberdeen, Md.
Baltimore, Md.
Buffalo, N. Y.
Erie, Pa.
Harrisburg, Pa.
Reading, Pa.
Philadelphia, Pa.
Atlantic City, N. J.
Cape May, N. J.

Carlstrom Field, Arcadia, Fla.
Tampa, Fla.
Dodge City, Kans.
Concordia, Kans.
Iola, Kans.
North Platte, Nebr.
Omaha, Nebr.
3-Drexel, Nebr.
Lincoln, Nebr.

Kelly Field, San Antonio, Tex.
San Antonio, Tex.
Corpus Christi, Tex.
Taylor, Tex.
Del Rio, Tex.
Abilene, Tex.

Fort Bliss, Tex.
El Paso, Tex.
Santa Fe, N. Mex.
Roswell, N. Mex.

Chanute Field, Rantoul, Ill.
Peoria, Ill.
4-Chicago, Ill.
Springfield, Ill.
Hannibal, Mo.
Columbia, Mo.
St. Louis, Mo.
3-Royal Center, Ind.
Terre Haute, Ind.
Green Bay, Wis.
La Crosse, Wis.
2-Madison, Wis.
Miami, Fla.

March Field, Riverside, Calif.
Los Angeles, Calif.
Tonopah, Nev.
Independence, Calif.

Fort Benning, Ga.
Macon, Ga.
Atlanta, Ga.
Augusta, Ga.
Savannah, Ga.
Thomasville, Ga.
Greenville, S. C.
Columbia, S. C.
Charleston, S. C.
Anniston, Ala.
Birmingham, Ala.
Montgomery, Ala.
Mobile, Ala.
Meridian, Miss.
Pensacola, Fla.
Chattanooga, Tenn.

Crissy Field, San Francisco, Calif.
2-4 San Francisco, Calif.
Fresno, Calif.
Milwaukee, Wis.
Des Moines, Iowa.
Dubuque, Iowa.
Davenport, Iowa.
Keokuk, Iowa.

Mitchell Field, Garden City, L. I., N. Y.
Portland, Me.
2-Burlington, Vt.
Northfield, Vt.
Boston, Mass.
Providence, R. I.
Hartford, Conn.
New Haven, Conn.
Nantucket, Mass.
Canton, N. Y.
Oswego, N. Y.
Syracuse, N. Y.
Rochester, N. Y.
Albany, N. Y.
2-Ithaca, N. Y.
Binghamton, N. Y.
Scranton, Pa.

Langley Field, Hampton, Va.
Cape Henry, Va.
Norfolk, Va.
Manteo, N. C.
Hatteras, N. C.

Forecast centers in italics.
*Climatological section center. †Aerological station. ‡Forest Experiment station; maintained in cooperation with Forest Service.
§Closed from April to October, inclusive.

Official Regulations Governing British Helicopter Competition

FOLLOWING are the official regulations governing the competition for prizes amounting to £50,000 offered by the British Air Ministry:

The Air Council have decided, as announced by the Secretary of State for Air, to offer prizes amounting to £50,000, for the successful completion of certain flying tests applicable to a helicopter or equivalent type of flying machine.

The conditions of entry and the tests to be carried out are as follows:

1. The Air Council will subject to and in accordance with the Conditions of the Competition award prizes amounting to the sum of £50,-

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000 in connection with the production of a flying machine which carries out independently of the existence of any bouyant structure or of power or assistance supplied from any source external to the machine and to the satisfaction of the Judging Committee appointed by the Air Council the tests specified in Condition 4.

2. All entries by persons intending to enter flying machines for the competition must be sent to the Secretary, Air Ministry, before 30th April, 1924. No entry received after 30th April, 1924 will be accepted.

3. Flying machines when undertaking the tests named in Condition 4 will be required to carry a pilot, sufficient fuel for one hour's flight and 150 pounds of military load.

4. The following are the tests to be undertaken by flying machines entered for the competition.

Test (a) The flying machine must make —

(I) In a ground wind not exceeding five miles per hour, and

(II) In a ground wind exceeding ten miles per hour, but not exceeding 20 miles per hour

a vertical flight from a position of rest on the ground to a height of 2,000 feet and descend and land without damage.

Test (b) The flying machine must make in a ground wind not less than five miles per hour and not exceeding twenty miles per hour a vertical flight from a position of rest on the ground to a height of 2,000 feet and remain in the air at an altitude of 2,000 feet for half an hour in a stable attitude over a ground area determined by the Judging Committee and thereafter descend and land without damage.

Test (c) The flying machine must make a vertical flight from a position of rest on the ground to a height of 2,000 feet and must fly over a prescribed closed circuit of not less than 20 miles in length at an approximate constant height of not less than 2,000 feet, and at an air speed of not less than 60 miles per hour and thereafter descend and land without damage.

Test (d) The flying machine must make in a ground wind not less than five miles per hour or exceeding 20 miles per hour a vertical flight from a position of rest and be manoeuvred while in the air over a given ground point as directed by the Judging Committee and must descend vertically from a height of not less than 500 feet without engine, and alight without damage within a confined circular area on the ground having a radius of 100 feet and the given ground point as centre.

5. The term Vertical Flight in paragraph 4 means a flight executed from the starting point without appreciable divergence from a vertical line passing through such starting point.

6. A separate entry must be sent in respect of each flying machine intended to be entered for the competition. The Air Council reserve the right to refuse any entry sent in.

7. Entries must be made by the owner or owners of the flying machine upon the form of entry provided by the Air Council, and must state the name, address, profession and nationality of the owner or owners and the names, addresses and nationality of any person or persons having an interest in the machine.

8. Entrants will be required as a condition of the acceptance by the Air Council of the entry to furnish the Air Council with their written acceptance of the conditions of the competition together with the written consent to the entry and acceptance of the Conditions of the Competition of any person or persons having an interest in the flying machine entered.

9. Entrants must also if called upon to do so furnish the Air Council with such further document declaration or other evidence as the Air Council may require to satisfy them that the entry is made with the consent of any person or persons having an interest in the flying machine entered and that such person or persons accept and agree to be bound by the Conditions of the Competition.

10. The Air Council reserve the right to add to or alter any of the conditions of the Competition other than the tests to be undertaken by flying machines and the amounts of the prizes to be awarded for each test.

11. Each entrant must at the time of entry furnish particulars of all patents which have been applied for or granted and of all designs for which registration has been applied for or granted in respect of inventions or designs embodied or made use of in or in connection with the flying machine entered.

12. Each entrant must at the time of entry furnish the Air Council with a description and general arrangement drawings of the flying machine entered and must give such further information in regard thereto as may be required by the Air Council, and at the conclusion of any test named in Condition 4 the Air Council or any person or persons appointed by them shall be at liberty to examine any flying machine which has undergone the test and to take records for the use of the Air Ministry of such measurements, particulars and details as may be desired and the entrant, his servants and agents shall afford all reasonable facilities and assistance for the purpose.

13. The Air Council will in due course after the date on which entries close proceed with the tests of flying machines which have been entered for the competition and will notify entrants of the time and place appointed for tests of the machines entered by them but no time and place will be notified to the entrant of any machine and no test of any machine will be held until all the conditions of the Competition required to be fulfilled by the entrant of such machine have been complied with.

14. In the event of any one of the four tests named in Condition 4 not having been held in respect of any flying machine entered for the Competition within a period of 12 months from the date on which entries close such machine shall be deemed to be withdrawn from the Competition by the entrant as respects any test or tests which have not then been held in respect of the machine and the machine shall be disqualified from competing further for any prize other than the prize or prizes (if any) allocated under Condition 19 in respect of the test or tests which the machine has carried out.

15. The tests named in Condition 4 will be carried out under the control and direction of the Judging Committee appointed by the Air Council and the Judging Committee may make such rules with regard to the conduct and carrying out of the tests or any of them (including disqualification of competing machines) as they may think necessary. All instructions given to entrants or their servants or agents by the Judging Committee and all rules made by them will be duly observed by entrants and their servants or agents.

16. The decision of the Judging Committee appointed by the Air Council on any matter connected with the tests or the allocation of the prizes and the decision of the Air Council on any other matter connected with or arising out of the Competition shall be final and without appeal.

17. No application by entrants for financial assistance from public funds will be entertained by the Air Council who will undertake no responsibility in respect of any expenses incurred by entrants in connection with the design, construction, transport or test of flying machines entered by them. All such expenses (including travelling and other expenses of the Judging Committee appointed by the Air

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SPEAKING as a member of the International Aerial Convention that took place in London recently, Sir Sefton Brancker said:

"There is a spirit about aviation which tends to cooperation instead of eternal bickering and fighting over small points. There is more natural trust and cooperation between nations in aviation than on any other matter and I am not at all sure that the International Air Convention of October 1919, will not be one of the biggest weapons for peace of the League of Nations."

We entirely agree with General Brancker's views regarding the spirit of international cooperation that is prevalent in aeronautics in every country except our own. As a matter of fact the United States was one of the signers of the Air-Convention of 1919, but that convention was never ratified by the Congress of the United States. The reason why it was not ratified was that the air convention of 1919 led to the establishment of the "Commission Internationale de Navigation Aerienne". (C. I. N. A.), which, according to Article 34 of the Convention is placed under the direction of the League of Nations.

The C. I. N. A. is an international organization in which fifteen governments are represented. The seat of this organization is in Paris. The governing body is in Geneva at the headquarters of the League of Nations. It is managed by a General Secretary, Mr. Albert Roper, a Frenchman formerly attached to the General Staff of Marshall Foch, and by two secretaries, Mr. Boulanger, a Frenchman and M. Peverell an Englishman.

The C. I. N. A. is an Official International Commission interested mainly in the international political aspect of aerial navigation, which however, has the power to formulate and to bring about the adoption of laws and regulations on commercial aeronautics which some day may prove very embarrassing indeed to these countries that have elected to stay out of the C. I. N. A.

As far as we are concerned, we are out of the C. I. N. A. and we will probably keep out of any commission, league or tribunal exercising super-governmental rights over this country. We cannot, however, ignore the fact that commercial aeronautics has an international as well as a national aspect. Commercial aeronautic interests bearing on international aerial navigation are problems affecting the interests of business men more than the interests of the governments.

What we need is an International Aeronautic Association representative of commercial aeronautic interests of all countries and which will perform in aeronautics the same functions that the C. I. N. A. is now attempting to perform, but from a new standpoint—from the standpoint of business and technical interests of all countries and without any reference to politics, the League of Nations or any international tribunal.

We have an International Chamber of Commerce. Why should we not have an International Aeronautic Association?

American foresight and business initiative were responsible for the creation of an International Chamber of Commerce in 1919. Will we *have* an International Aeronautic Association created through the initiative of American business men or shall we wait until the initiative in this matter is taken by some other nation as it has been the case so far in aeronautics?

We address these two questions to American business men interested in making America first in the air.

THE following resolutions were adopted at the Second Congress of the International Chamber of Commerce which took place in Rome last March:

"The Second Congress of the International Chamber of Commerce hereby recommends:"

1—"That the International Chamber of Commerce establish a permanent Advisory Committee which will include financial, industrial, legal and aviation experts.

2—That this permanent Committee examine the steps practicable, both immediately and subsequently to promote the international development of civil aviation for commercial purposes.

3—That the Committee maintain touch with any national or international organization so as to insure the closest collaboration, and that it exert every means at its disposal to increase the interest of financiers and business men in this respect with a view to arriving at an international regulation of aerial navigation."

The organization of this committee with the functions specified above were suggested in the June 5th, 1922, issue of the "Aerial Age" in the article on "Commercial Aviation Development in the United States", by William Knight, (see pages 294 and 311). The "Aerial Age" wishes to compliment Mr. Howard Coffin, President of the National Aeronautic Association of the U. S. A., upon the prominent part that he has had in having this resolution adopted by the Second Congress of the International Chamber of Commerce.

At the same time, however, that we unreservedly endorse the idea of creating an International Advisory Committee for Aeronautics as a permanent committee of the International Chamber of Commerce, we believe that aeronautic interests in the world are sufficiently broad, sufficiently important and sufficiently developed at the present time to lead to the creation of an International Aeronautic Association or of an International Chamber of Commerce specifically interested in aerial transportation. Aeronautics in our estimation has outgrown the stage of development when it mostly needed *advice* from either National or International Advisory Committees.

What aeronautics needs the most today is *action*. Action by business men who will avail themselves of the services of advisory committees whenever they need *advice*, in the meantime doing things in a business like way.

SINCE the war we have had at least a dozen International Aeronautic Expositions in Europe. Especially in Paris and London Aeronautic Expositions have been organized every year for the benefit of the export trade of French made aircraft and they have proved

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to be of the greatest benefit to the French Aircraft manufacturing industry.

On next August an International Aeronautic Exposition will take place in Sweden and no doubt it will be a great boom to the aeronautic industry of that country and it will open a new market where users of aircraft will go and in the future to buy aircraft. When are we going to have an International Aeronautic Exposition in this country where the airplane was born and which is leading the world in efficient operation of Commercial aviation?

Considering that we have been able to win all international records in aeronautics and are able to operate the U. S. Air Mail Service more efficiently and more economically than any other aerial operating concern in the world, we must have something to show and to sell in aeronautics to the rest of the world.

Who is going to discover America as a first class aircraft manufacturing nation? Who is going to organize an International Aeronautic Exposition in the United States? Who is going to prove that America is second to no other nation in the aircraft manufacturing industry?

We address this question to the National Aeronautic Association, to the Aeronautical Chamber of Commerce, to the Aircraft Manufacturers Association and to every individual and organization that wants to see America first in the air.

THIS month the Second Congress of Aerial Navigation will take place in London. At this Congress the matter of standardization of symbols, coefficients and methods of graphical representation used in aerodynamical publications and reports issued in every country, will be discussed. Recommendations to this effect were made at the first International Congress of Aerial Navigation which was held in Paris in November 1921, and some sort of action in this direction will develop at the London conference.

The matter of international cooperation in wind tunnel experimental work which is so vitally important to aircraft manufacturers of all nations will be discussed and a report will be made to the London Congress of the results obtained so far through a preliminary program of co-operative wind tunnel tests originated by the N. P. L. in England.

Germany as usual has not been invited to participate to the London Congress. Our own government will be represented as usual by representatives who will have no power to vote in any resolution adopted by the London Congress.

If the matter of International Standardization is going to be discussed and settled in London, what sort of international settlement will that be with the United States and Germany, (The only two countries in the world that have made any serious contribution to the development of aerodynamics), out of the way?

The National Aeronautic Association of U. S. A., is the only aeronautic body in the United States which is representative of National aeronautic interests, is not under the control of the U. S. Government and therefore is in a position to represent aeronautic interests of this country. This Association can take part in the discussion of international aeronautic problems and can vote on any resolution which will be adopted at the London Congress. This association can do for us what nobody could do at the First Congress of Aerial Navigation, when American aeronautics was conspicuously absent. We are confident that our National Aeronautic Association of U. S. A., will be properly represented in London.

Dr. Prandtl Joins Aerial Age Staff

DOCTOR of Philosophy and Doctor of Engineering Ludwig Prandtl, Professor at the University and Director of the Aerodynamics Experimental Station of Göttingen, Germany, has been appointed Associate Editor of AERIAL AGE.

Prof. Prandtl was born at Freising in Bavaria on February 4th, 1875. After attaining his B. A. degree, he studied engine construction at the Technical High School, Munich, from 1894-1898. He was then for one year with Prof. Föppl as his assistant in the laboratory for Mechanics and Testing Materials at the High School. Took his Doctor's degree at Munich University. From 1900-1901 was Engineer at the Augsburg Engine Works at Nürnberg. Although up to this time he had specialized in problems of Elasticity, he took up at this time the then unsolved questions of aero-dynamics and was commissioned to do some very important work in this new field of activity. In autumn 1901 he was appointed Professor of Applied Mechanics at the Technical High School of Hannover. From there he went, in the autumn of 1904, to the University of Göttingen. The research laboratory of this university which is now under his direction gave him the opportunity to test his theories on hydro-dynamics. He found there, too, a number of gifted students who participated in his researches, and aided him with mathematical and experimental contributions. In 1907, he successfully built a small aerodynamics laboratory, with funds contributed by the "Society for the Study of Aero-engines". This laboratory was afterwards taken over by the University. In the war years of 1915-17, he was enabled to build the large Aero dynamics Experimental Station, which still exists. The chief research work was done, however, in the smaller station in 1907.

Dr. Prandtl

(Concluded on page 282)

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Howard E. Coffin, Pres. B.H.Mulvihill, V.Pres. B.F.Castle, Treas. John B.Coleman, Rec.Sec.

Official Bulletin of National Aeronautic Association of U.S.A.

Col. H.E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D.C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

SINCE the last bulletin printed through the courtesy of the Editor, the chapter movement in the membership plans of the Association has made gratifying strides. The activities are listed by Districts.

FIRST DISTRICT

Requests for the formation of chapters from this District have reached national headquarters from the Mayor of Boston; William P. Sheffield of the Chamber of Commerce of Newport, R. I.; from the Chamber of Commerce of Providence, R. I.; while Frederick K. Harris, President of the Aero Culb of Vermont, states that the Aero Club will be changed to a chapter of the N. A. A. New Haven has also applied for a charter for a chapter in that city.

SECOND DISTRICT

Applications for chapters have been filed from Paterson, and Montclair, N. J.; Rochester, Albany, Gloversville, Binghamton, Newburg, and Watertown, N. Y.

THIRD DISTRICT

Applications have reached headquarters for the formation of chapters from the following cities:—Allentown and Pittsburgh, Pa.; and from Richmond, Danville, Roanoke, and Suffolk, Va., these cities and towns having undertaken the formation of chapters.

FOURTH DISTRICT

Chapters are being formed in Atlanta and Columbus, Ga.; Montgomery and Birmingham, Ala.; Tuscaloosa, Miss.; Pensacola and Tallahassee, Fla.; Macon. Ga.; Natchez and Pascagoula, Miss.; Statesville and Spartansburg, S. C.; and Chattanooga, Tenn.

FIFTH DISTRICT

Chapter activities are under way in Indianapolis, Vincennes, and Fort Wayne, Ind.; Louisville, Ky.; Akron, Lorain, and Painesville, Ohio; also in Xenia and Dayton, Ohio; and in Wheeling, West Va.

SIXTH DISTRICT

Chapter organization is now going on in Monmouth, Ill.; Battle Creek, Detroit, and Wekkston, Mich.; and in Milwaukee, and West Bend, Wis.

SEVENTH DISTRICT

A chapter has been formed in Davenport, Iowa and others are being formed in Duluth, Minneapolis and St. Paul, Minn.; St. Louis and Kansas City, Mo.; Waterloo, Des Moines and Cedar Rapids, Iowa; and Omaha, Neb.

EIGHTH DISTRICT

Chapter activities are going on in Prescott and Phoenix, Ariz.; Ft. Collins, Colo.; Elreno, Okla.; Dallas, San Juan and San Antonio, Texas; the chapter at San Antonio will be one of the largest in the south, over 300 members having already joined this chapter.

NINTH DISTRICT

Chapter formation is going on in Anaheim, Glendale, Pasadena, Sacramento, San Diego, San Francisco, and Los Angeles, California; Helena and Wolf Point, Montana; Eugene, Ore.; Sheridan, Wyo.; and Seattle, Washington.

These additions to previous lists show chapter activities in 147 cities and towns from the Atlantic to the Pacific coasts and from the Canadian border to the Gulf of Mexico.

Three Hundred Thousand Shriners from all over the United States will attend the Shrine Conclave in Washington the first week in June. Through the activities of the Association, the following organizations will stage what will probably be the largest aeronautical show ever held in the United States: Army Air Service; Bureau of Aeonautics of the Navy; Post Office Department; Weather Bureau; Bureau of Standards; and the Smithsonian Institution.

On Monday, June 4th, the Post Office Department and the Weather Bureau will hold exhibitions from 10 a. m. to 2 p. m. On Tuesday, June 5th, from 10 to 2 the Navy will conduct educational exhibitions of aeronautical activities in naval aviation. It is expected that the aircraft carrier, Langley, will be in the Potomac and that bombing and torpedo dropping, smoke screen and other purely naval aviation maneuvers will be carried out, and, in addition, the Marine Corps flyers will take photographs from the air, develop them in the air and drop the prints down to the crowd below.

On Wednesday, the 6th, the Army Air Service will carry out all kinds of aerial maneuvers incident to the wartime use of aviation and in connection, General H. H. Bandholtz will stage with the military forces, ground operations on the Monument Lot in coöperation with the Air Service.

Thursday will be aviation day at the Bureau of Standards and Friday, aviation day at the Weather Bureau, and, throughout the entire week, the Smithsonian Institute with its remarkable aviation exhibition, the Weather Bureau and the Bureau of Standards will be open to visitors. Consequently, the entire week will present a program along educational lines so that the business men represented by the Shriners will have first hand opportunity of inspecting the governmental air services and their activities and, it is believed, that the concrete evidence of aeronautics as a factor in the industrial life of the nation and as a vital adjunct to the national defense, will be better known.

By: C. A. Tinker,
Director of Information,
National Aeronautic Association.

(*Concluded from page 266*)

the light cord on the further arc is slowly wound on to it while the cord on the nearer arc unwinds. The lower ends of these cords are fastened to a lever system which transmits the average rotation of the arcs to a fine wire passing around a small shaft carrying the pointer of the graduated dial seen in the left foreground. The distortion thus registered in inches may be converted to degrees of arc by the use of a suitable factor. The downward motion of the specimen is eliminated from the dial readings by causing the dial and lever system to move downward at the same rate. This is effected by supporting the dial on the pantograph arrangement fastened to the crosshead and adjusted to reduce the crosshead motion by one-half.

The large weights seen on either side serve merely to counterbalance the weight of the disks on the sides not pendant from the frame. Coil springs inserted in the light chains just above these weights relieve the jar accompanying sudden failure of the specimen, and protect the chains against breakage.

(*Concluded from page 281*)

Prof. Prandtl's collaborators in the field of aero and hydro-dynamics should also be mentioned: First phase—Prof. V. Karman and Dr. Blasius; Second phase—Dr. Fuhrman (fallen in war); Dr. Föppl; Dr. Betz; and Dr. Wieselsberger. To these last two names are to be added those of Dr. Munk, now with the National Advisory Committee for Aeronautics, and Engineer Ackeret.

It should not remain unmentioned that the principal development of the Aero-dynamic Institution at Göttingen is due to the devotion of the celebrated mathematician, Felix Klein, whose life task has been the promotion of the applied Sciences, and their relation to pure Science.

Prof. Prandtl is one of the most distinguished scientists that honor Germany today and his contribution to the development of aerodynamics makes him a world leader in the scientific field of aeronautics.

AERIAL AGE considers it a great privilege to have Prof. Prandtl on its Editorial Staff and we are glad to welcome him as one of our family.

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THE NEWS of THE MONTH

The McLeish Memorial Aeronautical Library

Acceptance on behalf of the National Aeronautic Association of U. S. A., of a gift of a complete collection of books on aeronautics and kindred sciences, has been announced by B. H. Mulvihill, vice president. The gift collection has been named at the request of the donor, "The McLeish Memorial Library," in honor of Lieutenant Kenneth McLeish, U. S. N., Naval aviator, who died in combat during the World War.

The donor is Lieut. Clifford A. Tinker, a member of the Association attached to the staff at National Headquarters, who stated in offering his large collection of volumes on aeronautics that he hoped thereby to establish the nucleus of a research library available to all persons interested in the science and engaged in activities furthering the progress of aeronautics in the United States. Lieut. Tinker has also furnished a handsomely engraved book-plate for the library, which, it is hoped will receive from authors and publishers additions of books so as to keep the collection abreast with modern thought, invention, and practice in aeronautics.

"The gift", says Lieut. Tinker, "is a slight token of my appreciation of the Association and of my comrade Kenneth McLeish". McLeish, who was born in Glencoe, Ill., was an ensign in the Naval Reserve Force when the United States entered the World War. He went to France in October, 1917, and in December was sent to the aviation acrobatic school at Gosport, England, for instruction. He was later instructed in aerial gunnery at the Royal Flying Corps School in Turnberry, Scotland, and in squadron formation flying at the school at Ayr, Scotland. In March, 1918, he was assigned to the U.S. Naval Air Station at Dunkerque, and promoted to the rank of lieutenant. He then took a course in day bombing in France while on duty with the Northern Bombing Group, to which he was assigned on October 4, 1918. He was operating with a British squadron of bombers over Leffingem, Belgium, on Octoher 15, when attacked by an enemy combat group. McLeish, who was flying a faster airplane than the British bombers, engaged the enemy while the slower ships escaped. He shot down several of the attacking planes and was himself sent to earth after one of the most gallant exhibitions of courage, fortitude and fighting ability exhibited by an American aviator throughout the war. When hostilities ceased his body was found at Schmore, Belgium.

Lieut. Tinker was acting chief engineer of naval aviation in Europe during the World War; aide to Secretary Daniels in the trans-oceanic flight of the NC-4 seaplane which flew across to Portugal, and was on duty with the ZR-2 rigid airship detachment in England, press of business in London detaining him from making the last disastrous flight of that unfortunate craft. As aide to Rear Admiral W. A. Moffett, chief of the Navy's Bureau of Aeronautics, he was engaged in writing the history of naval aviation, and his authoritative articles on aeronautics have appeared in the leading magazines here and abroad.

In accepting the gift from Lieut. Tinker, Vice President Mulvihill wrote: "I am at a loss for words to express my deep appreciation of your gift and in accepting it, I can only say that this gift is comparable to your great interest in and efforts toward helping the Association achieve its principal aim of placing 'America First in the Air.'"

The library will be installed at National Headquarters, 26 Jackson Place, Washington, D. C., and the National Aeronautic Association is having prepared a memorial volume relative to the foundation to be presented to the parents of Lieut. McLeish.

Dept. of Agriculture Uses M. B. Balloon

The M. B., a new motor-balloon craft designed for the Army, capable of hovering over a specified area, has been turned over to the Department of Agriculture to fight the gypsy moth which is destroying the forests of northern New England. The ship has been tested at the Army Air Service engineering division at Dayton, O., and will fly to Concord, N. H. starting June 1, by way of Hammondsport, N. Y., where the craft was constructed by Airships, Inc.

This motor balloon, according to the builders, is a new development, on finer lines than the service "blimp", equipped with two motors of 75 horsepower each and capable of carrying five passengers. An Army crew will navigate the ship, which will be based at Concord for the extensive operations over the rapidly disappearing forests. The craft is supplied with a new type of mobile field equipment, and when on the ground will be held to a folding mooring mast anchored on a motor truck. Trucks will also carry a gas compressor plant to supply the hydrogen, so that the outfit will be self-contained wherever it may be operating.

Beckwith Havens, vice president of Airships, Inc., builders of the M. B., stated that this ship was the first to be constructed in the United States specifically for the purpose of spraying and powdering with chemicals forests infected by parasites, and the first craft of its size to utilize two motors. At the headquarters of the National Aeronautic Association he urged that this field of "salvage" by using aircraft be cultivated through an educational movement to present to the states battling against plant-destroying pests the economic utility of airships as well as airplanes.

New York State, he said, has appropriated $150,000 to fight the gypsy moth along the border from the St. Lawrence river to Long Island Sound, but this effort from the ground is destined to prove inadequate, according to Mr. Havens. With aircraft, Mr. Havens said, a great area can be sprayed in a few hours, and repeated spraying overtake the new breed of moths as they appear. The work in New Hampshire is in conjunction with the Federal government and will be conducted on an approved plan of campaign.

N. A. A. To Press New Rule for Flights in U. S.

The dissatisfaction expressed by Lieuts. Macready and Kelly because the existing rules of the Federation Aeronautique Internationale do not allow a world record for their non-stop flight from New York to San

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Diego, and the indignation felt that the United States is penalized because long distance straight-away flying is possible without crossing a border line, will probably result in amendment of the rules. This opinion was expressed today by officials of the National Aeronautic Association of U.S.A.

"Our petition to strike out the requirement in distance flight of the restriction forcing avaitors 'to return to the point of departure,' was filed at the March meeting of the F.A.I. in Paris," said B. H. Mulvihill, vice president of the association. "The Contest Committee, thru its chairman Col. F .P. Lahm, of the Army General Staff, therefore anticipated by several months a performance which would show the injustice of this restricting rule. The wonderful cross-continent flight of Macready and Kelly did this convincingly.

"The F.A.I. is charged with the international regulation of aeronautics for the purpose of making comparable the results of all trials, races, etc., also with actual supervision of aeronautical activities. As the American representative of the F.A.I.," Mr. Mulvihill pointed out, "the National Aeronautic Association, as it declared in the statement issued on May 3, cannot do otherwise than obey the statutes of the international federation. Our Association by its petition filed for consideration at the March meeting in Paris has taken the only course left open to us to secure amendment of this obnoxious rule. The amendment to become effective must be adopted by a two-third vote, and we are confident that the strong argument presented by our Contest Committee will appeal to the sportsmanship of the bodies co-operating in the F.A.I., which is primarily a federation controlling aeronautic sport in 23 countries, including the United States."

The plans for national recognition of the achievements of Macready and Kelly and all the fliers who shared in breaking eleven world records at a public ceremonial in Washington are taking shape, said Mr. Mulvihill. The idea has met nation-wide endorsement and interesting details of the ceremony will shortly be announced from Washington headquarters of the N.A.A., it was stated.

Will Offer $235,000 as Helicopter Prize

The Air Ministry in the near future will announce the offer of a prize of £50,000 (about $235,000) for a successful helicopter device enabling airplanes to rise vertically from the ground, descend in a like manner and to hover stationary in the air.

The winning machine must attain an altitude of 2,000 feet, carry a pilot and enough gasoline for an hour, fly at least sixty miles an hour and remain stationary in a twenty-mile wind for half an hour.

Army Board Finds Air Defense Vital

The value of aircraft for coast defense purposes when used with coast artillery weapons was demonstrated in joint exercises recently held at Fort Monroe by the Coast Artillery and Air Service forces of the regular army.

The special board which observed them has just submitted to the Secretary of War a report in which, among other things, it asserts that artillery fire can be satisfactorily conducted by the use of airplane data alone, when visibility from shore stations is interfered with by any cause, provided two-way radio communication is assured.

During the exercises airplanes were used for "spotting" the range and position of targets, for dropping bombs on targets, and in the projection of smoke screens. For military reasons the exact nature of the problems undertaken is not disclosed, beyond the statement that the board observed the results of a series of ten typical major operations, each of which constituted a problem in the combined use of coast artillery and air service elements. The results, however, were most gratifying.

Salient feautres in the conclusions of the board relative to these problems are:

"First—That the air service can locate and report the approximate position, direction and speed of hostile ships and inform shore stations of appreciable changes in such data, provided two-way uninterrupted radio communication is obtained and visibility is at least fair.

"Second—That this information is not only valuable for giving warning of the apparent intentions of hostile fleets, but also for placing initial shots by coast artillerists, and for the correction of firing data so as to bring successive shots effectively near the target.

"Third—That the radio direction-finders have not been developed sufficiently yet to be effective, but the result of their use justifies extensive investigation and development in the future.

"Fourth—That the present development of radio permits the use of about six planes, working simultaneously with as many ground stations, in a single locality, but if greater numbers are used the interference of wave lengths become excessive."

Secretary Weeks has approved the report and has directed Major Gen. Frank W. Coe, Chief of Coast Artillery, and Major Gen. Mason M. Patrick, Chief of the Air Service, to draft a tentative instruction manual for guidance in combined coast artillery and air service exercises.

"Both coast artillery and air service," the board declares, are essential to successful operation of coast defense. The exercises were not sufficiently comprehensive to determine the relative efficiency of seacoast gun attack and aircraft attack upon naval ships within gun range. Both have exceedingly great value and should be used in co-operation. Hostile ships can probably jam our radio communication, but by so doing they would also seriously interfere with their own vital radio communications. Our planes could then probably act at shorter range with effectiveness."

Some of the board's detailed conclusions are disagreed with by General Patrick, Chief of the Air Service, who feels that the exercises were not sufficiently comprehensive to give definite conclusions.

Fear Aircraft Shortage

A special board, composed of General Staff officers, has been convened by the War Department to investigate and report to Secretary Weeks on the aeronautical industry in the United States. Army officers, charged with organizing key industries as a part of the peace time industrial mobilization, have learned that many air craft plants developed during the war have practically ceased to exist and that there are only about twenty now operating. These, in the opinion of some Air Service officials, are inadequate to the military needs of the country in case of emergency.

Information laid before the War Department says in part:

"The aeronautical industry in the United States today is at a very low ebb, with little prospect of improvement in the near future. Unless something is done to remedy this situation it will become worse in the next year or two."

This opinion is known to be supported by Major Gen. Patrick, chief of the Army Air Service, who left Washington recently to visit various Air Service stations and industrial centres. He recently reported that commercial aviation had not developed to the point where it offered sufficient encouragement to aircraft manufacturers, and military peace

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time demands did not permit the army and navy to place orders in sufficient quantity to keep the industry at work.

American Balloon Races July 4

Fourteen balloons will start in the national elimination race from Indianapolis, Ind., on July 4, according to announcement of the contest committee of the National Aeronautic Association, which approved the date for the annual balloon meet. Three of the entries promise some sensational departures from the usual balloon design, it is reported from Indianapolis, whose Aero Club and Chamber of Commerce jointly are promoting the contest. A purse of $3,000 will be divided $1,000 first, $800 to second, $600 to third, and $300, $200 and $100 to fourth, fifth and sixth, respectively.

The contest is for distance navigated and the three leaders automatically become the entrants from the United States in the international balloon race to be held in Belgium next September. The Army and Navy air services will each enter two balloons at Indianapolis. The official starters, timers and observers will be appointed by the National Aeronautic Association, which is the sole representative in America of the world aeronautic federation, known as the F.A.I.

American Airmen Credited with 11 Records in 20 days

Eleven records, six of them exceeding accepted world marks, have been officially credited to American aviators by the contest committee of the National Aeronautic Association, Chairman F. P. Lahm. These records were all made in a period of 20 days from March 29 to April 17 at Dayton, Ohio, by Army aviators. Five of these records for speed over distances from 2,000 to 4,000 kilometers are entirely new performances in the history of aviation.

The United States is now credited with fourteen airplane records which have been accepted by the National Aeronautic Association and authenticated to the federation of aeronautic bodies.

The altitude world mark of 34,509.5 feet made by Lieut. John A. Macready has stood since Sept. 28, 1921. The 100 kilometer speed record and the 200 kilometer speed record, made by Lieut. R. L. Maughan, have not been exceeded since flown Oct. 14, 1922. In these performances Maughan made speeds of 205.31 and 205.94 miles per hour, respectively. The official figures for the eleven new records are as follows:

Airplane Speed Records

Maximum over one kilometer: 236.587 miles per hour, by Lieut. R. L. Maughan, U.S.A., (March 29) exceeding record of Sadi Lecointe, France, of 233.01 miles per hour.

500 kilometers: 167.807 miles per hour, by Lieut. Alexander Pearson, U. S.A., (March 29) exceeding record of Lieut. Batelier, France, of 114.45 miles per hour.

1000 kilometers: 127.43 miles per hour by Lieuts. H. R. Harris and Ralph Lockwood, U.S.A. (March 29) exceeding record of Lieut. Carier, France, of 75.81 miles per hour.

1500 kilometers: 114.33 miles per hour, by Lieut. H. R. Harris, U.S.A. (April 17) exceeding record of Boussoutrot and Bernard, France, of 58 miles per hour.

2000 kilometers: 114.22 miles per hour, by Lieut. H. R. Harris, U.S.A. (April 17).

2500 kilometers: 71.83 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

3000 kilometers: 71.62 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

3500 kilometers: 71.34 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

4000 kilometers: 70.77 miles per hour, by Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17).

Airplane Duration Record

By Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17) 36 hours, 4 minutes, 0.31 seconds; exceeding record of Bossoutrot and Drouhin, France, of 34 hours, 19 minutes, 7 seconds.

Airplane Distance Record

By Lieuts. John A. Macready and Oakley C. Kelly, U.S.A. (April 16-17) 2516.55 miles; exceeding record of Boussoutrot and Bernard, France, of 1190.04 miles.

The maximum speed record over the one kilometer course was first accredited to Lieut. L. J. Maitland, at 239.95 miles per hour, but this mark was not accepted because of a technical violation of the rules, Maitland's plane on two trips over the course failing to maintain horizontal flight. Under the official rules the flight of Lieut. R. L. Maughan of 236.587 miles per hour established a new world record, exceeding the mark of Sadi Lecointe of France of 233.01 miles per hour by more than three miles. The record has been authenticated as Maughan's, although the officials declare that Maitland's technical violation was undoubtedly unintentional on his part and that probably no speed was gained by the gradual descent of his airplane while speeding across the short course. The Contest Committee of the N.A.A. in a letter to Maitland says: "You have shown yourself to be one of the greatest high speed pilots in the world, and regardless of our inability to homologate your flight, it will always be felt that you have traveled faster than any human being on earth:"

Eleven Countries Agree on National Plan to Promote Civil Air Transport

In their opinions of commercial conditions in Europe brought home from the International Commercial Congress at Rome by members of the large American delegation there is no deeper note of optimism than that relating to aeronautical progress. From reports of the delegates who represented the National Aeronautic Association of U.S.A., headed by Howard E. Coffin, of Detroit, president of the association, the precipitation by the Americans of the sentiment of the air group into an agreement upon a formula of principles for the promotion of civil air transportation was one of the outstanding accomplishments of the congress. This group considered the question from a purely business point of view and its conclusions were incorporated in a resolution adopted by the congress declaring the extreme importance of air transport made necessary the development of the commerical side of aviation as a powerful factor in the betterment of commercial relations throughout the world.

The resolution was the result of a thorough study of replies from eleven nations to a questionnaire on the problems of air transport made by a sub-committee whose members represented France, Great Britain, Italy and the United States. In its adoption the congress subscribed to the recommendation that "any national funds spent on aviation should be in part devoted to developing civil aviation and thereby create a permanent and eventually self-supporting form of transportation and which would at the same time be available for national defense."

Further, the congress accepted and endorsed the establishment of "a permanent international advisory committee, which will include finan-

(Concluded on page 298)

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Elias Night Bombardment Plane

G. Elias & Bro. Inc., of Buffalo, N. Y. were one of three successful competitors submitting to the Army Air Service designs for Type 12, Multi-seater, short distance night bombardment experimental airplane. This is the sixth award received by the Elias company in Army and Navy design competitions.

Aircraft Standardization

Several conferences have been held during the past month by the Aircraft Standardization Committee, representing the Society of Automotive Engineers, Aeronautical Chamber of Commerce and Manufacturers Aircraft Association. The preliminary drafts of a proposed code as circularized by the joint sponsors, are being examined in detail for sympathetic criticism and discussion in the near future.

Gothenburg Aero Exhibition

The following European companies have announced that they will participate in the International Aero Exhibition:

Great Britain: Vickers, Ltd. (flying machines). Bristol Aeroplane Co. Ltd., and Armstrong Whitworth Aircraft, Ltd. (both flying machines and motors) and Rolls-Royce, Ltd. (motors).

France: Sous-Secretariat d'Etat de l'Aeronautique (statistics, etc.) Aeroplanes "Caudron" (flying machines), Henry Potez (flying machines), Societe Nieuport Astra (flying machines and models), Societe Louis Breguet (flying machines and models), Pierre Levasseur (propellers), Establishments Liore et Oliver (flying machine), Societe Radio-Electrique (radio materials), Aera (Instruments), Paulin Ratier (propellers), Hanriot (flying machines) and La Hispano-Suiza motors).

Italy: Gianni Caproni (flying machine), Macchi (flying machine), Savoia (flying machine) and Gabardini (flying machine).

Czecho-Slovakia: Usines militaires (flying machines).

Germany: Junkers Flugzeugwerk A. B. (flying machines motors models). Dornier-Metallbauten G.m.b.h. (flying machines), Albert Wigand (instruments), Albatross G.m.b.h. (flying machine), Udet (flying mach.) Baumann & Lederer (flying materials), Bahnbedarf (flying materials), Baumer Aero (flying machine), Stahlwerk Mark (flying machines and motors), Steffen & Heyman (motors and flying materials), and Telefunken (radio materials).

Sweden: Swedish Army and Navy (flying machines, materials) Swedish Aero A.B. (flying machines) A.B.A. Wiklunds Maskin & Velocipedfabrik (motors), Gas Accumulator (wind direction indicator and possibly, air lighthouse), Transit Kompaniet (flying materials), Swedish Wireless Telegraphy A.B. (radio materials). Other reported exhibitors are: Accumulator A.B. Jungner, See Fabriks A.B., Swedish Ball Bearing Co., A.B., Mack Meters, Fagersta Bruks A.B., George Hjort & Co., Sandvike Iron Works and others.

There are 34 types of flying machines and 16 types of flying machine motors announced to be represented at the Exhibition. It is expected that there will be not less than 50 different types represented.

Air Mail Records Furnish Important Wind Data

Allowance must be made for a wind of about 7 miles an hour from the West, at the average altitude of air mail flight, it has been found from an analysis of one year's records of the Air Mail Service between New York and San Francisco. A discussion of the wind factor in flight as it affects commercial aviation was presented at the recent semi-annual meeting of the American Meteorological Society by W. R. Gregg of the Weather Bureau of the U. S. Department of Agriculture. Lieut. J. P. Van Zandt of the U. S. Air Service collaborated in analyzing the records.

A more detailed study of the New York to Chicago part of the route gives almost exactly the same wind factor as for the entire trans-continental route. This value of the wind factor has been verified by an examination of 8,700 upper air observations with kites and balloons, and the agreement is remarkably close. The importance of this agreement lies in the fact that, in fixing flight schedules in other regions or at other altitudes, dependence can be placed upon either method in case only one is available.

Schedules that can be guaranteed 90 per cent of the time have been determined for aircraft of any cruising speed between 50 and 150 miles per hour. In making up these schedules allowance has been made for head winds of 36 miles per hour or more in westward flight, and 20 miles per hour or more in eastward flight, as these winds have been shown by kite and balloon records to occur 5 per cent of the time. When they do occur flights will be somewhat delayed, but nevertheless completed. During the remaining 5 per cent of the time flights are likely to fail altogether or be seriously delayed because of exceptionally unfavorable weather, such as severe rain or snow storms, poor visibility and other difficulties.

Reed Metal Propeller

The following corrections should be noted in the article by Dr. Reed published in the April issue.

page 182, middle col., 4th line read "tip speeds seldom exceed 900 feet per. ."

page 183, middle column, 12th line, read "ratio of thrust to tip speed undergoes no appreciable variation. ."

page 183, 3d col., 18th line, read "50 per second. ."

page 185, 1st col., 13th line, read "682 ft. p.s. only," instead of 250 as printed

page 182, 3d col., 3d par. The asterisk should refer to "Berthall 'Guns and Gunnery'" and not to a paragraph of the article proper.

In the report of experiments on aerofoils at high wind tunnel speeds by the National Advisory Committee for Aeronautics published in 1920 the highest wind speed was 682 ft. per sec., whereas the air reactions described by Dr. Reed in his article do not begin to be important until a speed of nearly 1000 ft. per sec. is reached.

Tests were made in 1919 and 1920 at McCook Field of a metal propeller reaching a tip speed of over 1300 ft. per ft. per sec. but the propeller was fluttering violently and the highest tip speed reached without flutter was 837 ft. per sec. Therefore, the data for higher tip speeds are valueless for the purpose in hand.

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New Navy Pay Schedule

The new schedule of pay for civil employes in the Naval Establishment is announced, to take effect May 1.

In the Drafting Service, the rates of pay range from $4.16 for a plain copyist per day of seven hours to as high as $14.96 for chief draftsmen.

In the Technical Service, aeronautical aids receive $8.32 and $13.28, while aeronautical aid (photographic) is paid $13.28. An aeronautical engineer receives, $6.88, $7.20, $7.60, $7.84, $8.72, $9.44, $10.56, $10.96 while an assistant aeronautical engineer receives $6.08, $7.20 and $7.44. Oh, to be an aeronautical engineer! An assistant airplane inspector's pay ranges from $5.36 to $9.44.

Under the heading of Laborer, Helper and Mechanical Service, the maximum rate per hour is 73 cents for general or motor aircraft mechanic. "Motor" mechanic. The Navy has its own nomenclature. The N. A. C. A. dictionary means nothing to the Navy, if one judges from Mr. Roosevelt's pay tables.

All these salaries or pay do not consider the risk in flying, for all employes detailed to flying in connection with testing apparatus or appliances on aircraft or testing out aircraft are allowed 50 per cent additional to their regular rate of pay for the day they fly, but they shall fly only on approval of the commandant or other officer in charge. No employes shall fly without such authority, secured in advance for each flight.

Portable Mooring Mast for Airships

A portable rigid airship mooring mast which may be used extensively in advance base operations by naval airships and which would also have great value in connection with the commercial operation of airships is being developed by the Navy Department.

Preliminary design of the portable mast has been completed and if further development proceeds as favorably as at present, it is probable that several will be constructed for use in connection with the extended flights of the ZR-1.

The mast as designed is about 115 feet high as compared with 165 feet for the permanent mast at the Naval Air Station, Lakehurst. The portable mast, however, is intended to be set up with a minimum of labor and possibly to remain set up for a comparatively short space of time. Consequently the lower height of the mast would be an advantage, although it requires a little more careful handling of the ship while at the mast. The plans provide for an extremely simple structure. It is intended that as great a use as possible shall be made of the facilities afforded by the locality in which the mast may be set up and no extensive foundation or anchorage of concrete will be required.

The value of the portable mast to airship operations far removed from a permanent base is obvious. In this respect it lays claim to consideration not only from the military viewpoint, but as a means to facilitate exploration and commercial air lines.

Marines Fly Four Martin Bombers from Coast to Coast

Completing their transcontinental flight two days ahead of schedule, the four Martin bombers under the command of Major R. S. Geiger, USMC, arrived in Washington on Monday, April 30th, and were met by a distinguished party of government officials headed by the Secretary of the Navy. The four bombers left San Diego on April 19th for the overland flight and proceeding by easy stages across Texas and thence north to Kansas City made the flight without incident. It is estimated that $20,000 in transportation charges were saved to the Government by flying the planes overland. They would have necessitated a train of twenty cars if crated and shipped by rail. The pilots were greeted at the Naval Air Station, Anacostia, D.C. by Secretary Denby, Rear Admiral Moffett, Major General LeJeune, Major General Neville, Lt. Colonel Turner, Mrs. Denby and Mrs. Moffett, who congratulated them on their successful trip.

The Last of the P. T.'s.

Orders were issued by the Bureau of Aeronautics authorizing the turning in of all P.T. torpedo planes to the Naval Aircraft Factory upon the return of the Torpedo Plane Squadron to Hampton Roads from the winter base in Key West. The P.T. will be replaced within the coming month by the new DT torpedo plane which has shown such remarkable performance qualities in recent tests. The passing of the P.T.'s will cause little regret among the squadron pilots who have been looking forward with eagerness to the arrival of the new ships. However, the P.T. has been a valuable development type, and much has been accomplished with it in torpedo plane work that has paved the way to a wider field of usefulness for the advanced design.

Submarine Plane Has Further Trials

The submarine plane which has been under construction at the Martin plant in Cleveland for the Navy has had additional test flights by the test pilot of the Martin Company and by Lieutenants Pond and Strong of the Navy. It is expected that the tiny plane, the smallest seaplane in the world, will soon be brought to Anacostia for extensive trials. The MS has a span of 18 feet and the fuselage is 17-½ feet long. The power plant consists of a three cylinder 60 H.P. Lawrence engine. Fully loaded, the weight is 1,000 lbs. Assembled and ready for flight, it could be placed in an average size living room with plenty of space to spare.

ZR-1 Power Plant Under Test

The ZR-1 power plant complete is being given a test run at the Aircraft Factory mounted in one of the power cars. It is planned to complete and test the power cars at the Aircraft Factory and ship them to Lakehurst to be applied to the hull. The hull structure of the ZR-1 is practically complete and application of the outer cover has commenced.

New Landing Field for Aircraft Factory

Admiral Moffett recently went to Philadelphia by air to inspect the work on the new landing field that is being constructed adjacent to the Naval Aircraft Factory. Work has been started on the reclamation of 80 acres of ground to be made by dredging operations in the approaches to the League Island Navy Yard.

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When completed the field will be the finest in the eastern section of the country. It will be approximately 800 yards long and 400 yards wide with excellent approaches from all directions.

U. S. S. Langley

Reports received from the Langley indicate that landings and take-offs from the flying deck are made so frequently that it is becoming a routine matter. Aeromarine 39-B and Vought planes are used for such exercises. Extensive operations were carried on while the ship was at Panama to demonstrate for Army, Navy and civilian officials.

550 H. P. Model T Wright Engine Tested

Preliminary flight tests of a DT-4 plane equipped with a 550 H.P. Model T Wright engine were carried out recently at the Aircraft Factory in Philadelphia. The DT-4 differs from the DT-2 only in respect to the lower plant equipment.

Liberty Develops 470 H. P.

Preliminary bench runs of the Navy Aeromarine reconstructed Liberty engine at the Naval Aircraft Factory developed 470 H.P. at 1800 revolutions. A contract for forty of these engines has been let.

World's Record for Weight-Altitude

A new world's record was established by Lieutenant Rutledge Irvine, USN, at McCook Field, Dayton, O., when he ascended to a height of 11,300 feet with a load of 2405 pounds, and an observer in a Douglas torpedo plane. Irvine was in the air for two and one half hours. According to accounts of the test, it would have been possible to climb to 19,000 feet if the plane had been equipped with a super-charger. The altitude weight carrying record, lacking somewhat the spectacular features of other records in aviation, is of great importance, and of marked interest in connection with the development of the torpedo planes for service requirements. Those who have had experience with the P. T.'s which are now in use in the Fleet will appreciate the advantages of a torpedo plane with superior qualities of maneuverability and ceiling under full load conditions. The D. T. used by Lieutenant Irvine was equipped with a reconstructed Liberty engine which had been modified at the Washington Navy Yard.

18 Foot Propeller for ZR-1 Passes Test

The geared drive propeller which will be used on four of the Packard engines for the ZR-1 has successfully passed tests on the whirling stand at McCook Field. The power plant installation of the ZR-1 will be equipped with four geared drive and two direct drive propellers. The former are designed to absorb 300 H.P. The propeller which has been under test is 18 feet in diameter and is constructed of wood.

Smoke Screens Laid by Naval Aircraft

The possibility of laying smoke screens from aircraft has recently been under investigation at the Naval Air Station, Anacostia, D. C., and some very interesting results were obtained from experiments which point to the practicability of naval planes performing efficient duty in this manner. The smoke screen is created by chemical reaction and is projected from the exhaust line of the engine. One of the tests over the Anacostia River blanketed the Army War College in a heavy cloud of smoke. As a whole the experiments point the way to interesting and valuable developments in this line.

Speakin' of the record Some Reporters are Dumb

Maj. ——: Pretty good flight Macready made, wasn't it?

Reporter: Sure, indeed it was. Too bad it couldn't have been made by an American machine.

Maj. ——:What's the machine got to do with it—it was the engine. What do you want to do it with—a Jenny?

Reporter: Admittedly, the plane wouldn't fly without the engine. But it was the plane that carried the gas.

Maj.——: It was the engine that did it.

Reporter: Well the Navy developed the Liberty, didn't it?

Maj. ——: For an aeronautical expert, that's dumb.

Army Has Largest Non-Rigid Airship

The largest non-rigid airship in the world has just been completed at the plant of Airships Incorporated, at Hammondsport, N. Y., and delivered to the United States Army Air Service. The new ship, which possesses many novel devices, is known as the RN-1. It will be stationed at Scott Field, Belleville, Ill., the location of the second largest airship shed in the country, the largest being the double shed at the Naval Air Station, Lakehurst, N. J.

The Army RN-1 is 262 feet in length and more than 48 feet in diameter. It has a gas capacity for hydrogen or helium of 325.000 cubic feet of hydrogen or helium, can lift 21,000 pounds and maintain an altitude of 10,000 feet. It is primarily a fighting ship; and is equipped with bombs and machine guns. From the cabin which is 55 feet in length a gun tunnel extends upward through the hull to a fighting platform on top. This platform accommodates a machine gunner and two observers. A crew of twelve officers and enlisted men will operate the RN-1 and their training with the big non-rigid will begin at Scott Field within the next few days.

The RN-1 is powered with two 400 horsepower Liberty engines, which give it a speed of 60 miles an hour. The envelope of the airship is made of special 3-ply rubberized balloon fabric with an outer coating of aluminum—in all 6,000 yards of fabric were used, together with 300 gallons of special rubber cement, 60,000 feet of tape and 5,000 feet of steel cable.

The Verville-Sperry Performs

The Verville-Sperry Racer, which participated in the Pulitzer Race last October, and is now at McCook Field, was taken up recently for the purpose of obtaining moving pictures of the airplane in flight with the retractible chassis drawn in. The value of the retractible chassis arrangement is proven by the fact that official timing records of the airplane show that an increase in speed of 28.3 miles per hour is gained with the landing gear retracted during flight. The maximum speed of the airplane is 191.1 miles per hour in the retracted position and 162.8 miles per hour with the chassis in the normal position.

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EQUIPMENT DEVELOPMENT at McCOOK FIELD

NOT only has McCook Field been assiduous in the development of new and improved pursuit planes like the Fokker, observation, bombardment and attack craft, new armament, the Bothezat captive airplane, aircraft cannon and many other items, but the equipment of the airplane has been given close attention.

Electrical Equipment

The engine-driven generators of 25 and 50 amperes are now being developed as part of a central electric power plant for heating, lighting, radiotelephone and telegraph, etc. A satisfactory night landing lamp has been worked out and electrically illuminated instrument boards. Signal lights for code and inter-plane signalling by night have been worked out. Other devices for night flying, such as non-glow exhaust manifold, tracer ammunition, illuminated gun sights and parachute flares are being developed.

Two models of electric engine starters are now in use for "aviation" engines. Doubtless these can also be fitted to airship engines as well. A new and lighter suit of electrically heated fabric is being brought out. Development work continues on an electrical tachometer.

Instruments

Attempts are being made to get around the limitations of the magnetic compass by developing a gyroscopic compass or an earth inductor located in the tail of the machine. New projects in the instrument field include: field calibration outfit, new instrument manuals, air-speed meters for airships, air pulsation tachometer transmission, radium pen for use in barographs as a substitute for ink, which freezes; optical recording manometer for measuring pressures on control surfaces of airplanes under test, in which the National Advisory Committee for Aeronautics will be especially interested; the development of sensitive syphons, speed measuring station which will use the theodolite system for measuring speed, rate of climb and altitude of any airplane.

The chronometric tachometer has been modified to fit into a case in such a manner that the scale is straight and vertical instead of being around the circumference of a circle. A special fuel pressure gauge and engine altitude gauge have been developed for super-charger work. Development of an electric thermometer is under way. A combination engine gauge unit for fuel and oil pressure and temperature has been constructed. Gasoline level gauges have been developed and one type put in production.

Considerable thought and a large amount of development work has been done on navigation instruments. The development of a more accurate altimeter is under way as well as one for photographic use. Another for use in landing in a fog is being worked up. The standard compass, type B, has been modified so that it can be read when placed above the pilot, as in the center section of the upper wing, and is known as the Type B Inverted Compass. Air-speed meters of the pressure type are being developed to use a Pitot instead of the customary Pitot-Venturi tube. Several models of air sextants have been developed and tested.

An accurate barograph for high altitude work, using a syphon for the pressure sensitive element, has been developed. This has also been equipped with a mechanical movement which enables the pen to make double traverse of the drum, giving twice the scale length of ordinary barographs.

Rate-of-climb indicators have been developed by the Bureau of Standards and by the Pioneer Instrument Co. The Prouty oxygen regulator has been improved and put into production. Development work is being carried on with a view to utilizing liquid oxygen in airplanes.

Radio Equipment

It is expected the Signal Corps, which is charged with the development of radio sending and receiving sets, will develop a lightweight sending set for pursuit planes. In the development of accessories, with which the Air Service is charged, radio control is the problem being worked on, for use in the handling of manless airplanes or aerial torpedoes. Radio control is being placed in an airplane for test. The pilot can allow the radio mechanism to control the craft or throw it out of gear at will. An automatic transmitter and selector permits any one of twelve distinct controls to be put into operation. Radio control necessitated the development of an automatic stabilizer.

Automatic Stabilizer Wanted

McCook Field states that there is no successful automatic stabilizer on the market today "which will operate satisfactorily, hence we were compelled to undertake the development of one."

Radio control with secrecy of transmission and reception is the goal.

Aerial Photography

Study is being made of improved methods for holding a camera vertical when the picture is being taken. Aid is being given by the Bureau of Standards, the Sperry Gyroscope Co. and a Doctor Gray of Scotland.

A mobile photographic laboratory is being developed as well as a railroad car type. A new experimental camera with 36-inch lens has been made with which negatives with good detail are expected from 30,000 feet.

Radio in Navigation

"The development of radio aids to aerial navigation are very important," says the McCook Field report. "We now have a homing which allows us to fly directly toward a transmitting station. We are also experimenting on a method of directive transmission which will establish a radio line in any given direction down which a pilot may fly, even when above the clouds or in a fog." Experiments are anticipated, also, for a landing field localizer to assist the pilot in alighting in a fog.

"Radio makes it possible for the pilot to find out what the weather is on the course he desires to fly and while in the air. This enables him to avoid storms .....Attention is being paid to the marking of various towns in the United States .....and aerial lighthouses are being tested." One branch of the equipment section is experimenting with these operated by acetylene gas, automatically flashing.

Miscellaneous Development in Equipment

Improvement in parachutes is considered still desirable. The solution of the fire risk problem still remains at the head of the list. Flotation gear and means for releasing the wheels of the airplane have been devised. A fairly satisfactory portable engine cranker has been designed and put in production. A portable take-off mat, of two types, has been experimented with. One consists of a woven rope net covered with canvas and the other consists of canvas mats with hickory slats inserted therein. The latter seems better. These mats will permit take-offs from muddy fields.

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With the development of the supercharger came the demand for improved oxygen apparatus. The regulator known as the Dryer type is designated as "clumsy" and the Prouty has at times been inoperative so that it was necessary for McCook Field to design its own, using liquid oxygen and there has been installed a machine for reducing oxygen to a liquid state.

Work is going forward on a "unit flying suit," combining in one piece, moccasins, flying suit, helmet, face mask and goggles. It may be presumed, of course, that there will be room for a pocket flask. Non-fogging and frost-proof goggles are being sought. Experiments have been conducted with goggles having a partial vacuum between two lenses, and with goggles electrically heated.

An air-tight pilot's cabin has been constructed in a USD9-A for use at high altitudes. Ground level pressure within the cabin is maintained by means of a gear-type fan for driven air compressor.

Improvements are being tried in the clasping mechanism for safety belts. Other work is being done on life preserver cushions, observer's message holder, mechanical telautograph, towed targets, map cases and special machine shop trucks, airdrome illuminating trucks, trucks for aerial photography, radio, gasoline, etc.

McCook Has Practical Fire System

McCOOK Field announces that the equipment section of the Engineering Division of the Army Air Service is "developing a fire extinguishing system that it is believed will prove practical."

Of 1250 crashes investigated by flight surgeons in the period from the declaration of war to the end of 1919, 4.6 per cent were crashes in which fire occurred, either in the air or on the ground after alighting. For 1920 the percentage increased to 5.1 while for 1921 the percentage was 7.9. Last year 8.6 of the investigated crashes were fires, and of these 7.4 per cent occurred after landing, according to the best information obtainable. Of course, the 2159 crashes investigated were not all that occurred, nor were they all necessarily fatalities.

Fire in the air is a risk with which we may always contend. But it does seem particularly unfortunate that in a crash which otherwise might mean but a broken leg, or cuts, must cost a life for want of a fire preventative after the machine actually gets on the ground. Flying may have its risks but, after all these years, there would seem to be little excuse now for fires on the ground, after landing.

However, "a great deal of effort has been put forth to prevent the occurrence of fires in the air as well as fires resulting from crashes," says the report. "Considerable remains to be done along these lines before the situation is satisfactory."

The following apparatus is in course of development.

Leakproof and fireproof tanks, of metal covered with a combination of fabric and rubber. "These tanks have been but recently developed," says McCook. "It is expected that much more work will be done on the further development of these tanks. At present they are somewhat objectionable, due to the added weight involved, as well as their cost, and also the rapidity with which they deteriorate."

Crash-proof tanks, covered with material either inside or outside which renders them less likely to split and allow the contents to escape in case the airplane crashes.

"Many aviators," adds McCook, "have been burned to death from this cause alone. Several instances are on record where the aviator has had a slight crash which caused the tank to split and dash the gasoline over the hot *motor* (sic.) This has ignited the whole wreck almost instantaneously. In some cases the aviator has been unable to get out, due to being caught in the wreckage, and, in some instances, he was rendered temporarily unconscious by the shock of the crash and burned to death before he could be gotten out of the wreck."

"Some" instances is right. Twenty fires last year after crash, and 20 the year before that, in investigated crashes. However, it does not necessarily follow that these resulted in fatalities. The figures are not at hand for this but could, of course, be ascertained.

Then there are fire extinguishers and fire-extinguishing systems mentioned in the report.

"At present the only fire extinguishers carried on an airplane are the small hand operated type with a capacity of about 1 quart. These extinguishers are only useful to put out small fires that occur when the airplane is on the ground. In the air, they are practically useless, due, principally to the fact that the slipstream carries away the fire-extinguishing fluid discharged, which, normally, would blanket or suffocate the flames. In addition to their limited use, they require both hands to operate. The pilot must have at least one hand free for the control of the airplane.

"There is now in course of development by the equipment section a quart-size extinguisher that can be held and operated with one hand. It is hoped that this pistol type extinguisher may be found efficient in the air as well as on the ground, especially on ships that can not carry the weight of a complete fire-extinguishing system.

"The equipment section of the Engineering Division is also developing a fire-extinguishing system that it is believed will prove practical. It is now being installed in one of the training type airplanes. This system is built into the airplane and floods the engine compartment with extinguishing fluid under pressure. It is operated by a lever from the cockpit or will operate automatically under certain conditions. In case of a severe crash, the tank, located under the engine bearers, will be smashed, thereby allowing the fire-extinguishing fluid to vaporize over the engine and probably render fire less likely in event the gas tank splits and pours its contents over the motor. The carbon tetrachloride readily mixes with the gasoline vapor and renders the charged air less volatile.

"It may be found an advantage to combine the fire extinguishing fluid tank with the fire wall. That position, between the engine and the gas tank, might permit the extinguishing fluid tank to act as a buffer in case of a crash; in any event, its contents would reach the motor before the gasoline and possibly prevent a fire."

In a test already made of this system "a derelict plane provided with a Liberty 12 engine and propeller was used. In order to get a fire of intensity similar to what might be expected in the engine compartment oiled rags were placed around the carburetor; several gallons of gasoline were poured over the engine; and, after starting the

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motor, the combustible material was fired. For 10 seconds the fire was allowed to burn before the extinguishing system was turned on. It required about 6 seconds to extinguish the fire, using about 8 pints of carbon tetrachloride. Aside from fusing parts of the carburetor no material damage was done, although the engine was run at full throttle in order to simulate the slipstream of a ship afire in the air.

"Investigation is now under way of the possibility of fire in a crash caused by the exhaust manifolds being heated beyond the danger point. It is believed possible that some other metal, as aluminum, which rapidly cools and may be kept below the danger temperature, by using fins or giving the exhaust manifold more radiating surface, may relieve the situation. If we can combine freedom from the danger of fire from this source with an absence of glow in night flying, considerable satisfaction will be felt."

One can certainly vouch for the fact that "considerable satisfaction" will he felt by more than one pilot who has sideslipped to put out a fire. The eight plus per cent have nothing to say.

The New Wind Tunnel at McCook Field

By J. C. Branham

A NEW wind tunnel, which will afford much more convenient aerodynamic facilities than have hitherto been available, has recently been completed and put in operation at McCook Field. The use of this method of testing rapidly increased during a few years prior to 1920, and in that year the outside contracts under this item amounted to $30,000. In consideration of this annual outlay, and of the inconveniences resulting from having some of the tests made at distant points, it was found desirable to erect a new tunnel. Construction was begun in June, 1921, and the tunnel was completed in the summer of 1922. Since that time the plant has been in continuous operation, evaluating coefficients of aerofoils, model airplanes, etc.

The tunnel is 96 feet in length, with an airstream 5 feet in diameter, and requires the exclusive use of a standard 140 ft. Hangar. It is not a large tunnel when compared with some of those being used abroad. The size of the power plant, however, makes possible an unusual speed capacity, with a maximum of 275 miles per hour. The power plant was designed to use electric motors already on hand, so that the only outside purchase necessary was the motor generator equipment. Each of the two fans is driven in tandem by two Sprague dynameters, which were reserved from testing equipment formerly used for Liberty engines. Economy of first cost was thus achieved together with efficiency of operation.

Wind tunnel testing deals with the air forces of support, resistance and balance. Scale models are constructed of airplanes, dirigibles, wings, etc., the weight and material of which are of minor consideration. When these are mounted in the airstream of the tunnel, air forces arise the effect of which on the model can be measured. By applying "scale corrections", which are often small, the wind tunnel characteristics of the model furnish a reliable basis upon which to predict the flight performance of the full-size airplane. The Wright Brothers were the first to apply this principle to aerodynamic research; it was a vital step in their experimentation twenty years ago, as the design which finally gave them success was one previously determined upon by means of a small model in their wind tunnel.

A delicate balance, capable of measuring forces to one ten-thousandth of a pound, is located beneath the tunnel. This balance was built by a well-known manufacturer of telescopes, the design being based on an English type. A new wire balance for use at the higher speed ranges will soon be built.

The recent test of the Barling Bomber may be cited as an example of the method using the tunnel. A 1/70 scale model, complete with the exception of propellers, was made in the pattern shop, the rudders, ailerons, elevators, etc., being movable. A series of tests was then made to determine the degree of stability, together with the lift and resistance. The rolling, pitch and yawning tendencies were measured in inch-pounds with the control surfaces in various positions. From this data it was possible to predict the proper tail setting and the probability of easy control for the full-size airplane.

Operation of the tunnel requires precise physical laboratory methods throughout. There are many possible sources of error, any one of which may effect the results. A wind tunnel may be considered as the chief "Instrument of Precision" in the designers' hands. Since the object is to reach accurate conclusions in matters of design of new ships prior to the trial flight, the smallest details assume importance. For example, the direction and velocity of the atmospheric wind affect the readings of instruments inside the tunnel building. A similar effect is noticed, due to disturbance in air flow, when doors are opened, or when persons move about inside the building. It is for this reason that the doors are usually kept locked during a test.

A test represents about one percent or less of the total cost of a new experimental airplane. If a novel and untried design be shown by wind tunnel tests to be faulty, it is apparent that, neglecting engineering costs, 99 per cent of the project cost is saved, as compared with trial by actual flight. Again, when a new design is developed and perfected in the wind tunnel, as was the case in the early Nieuport monoplanes, the value of such test may be taken as equal to the cost of one completed experimental airplane, including engineering and overhead costs.

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Government Publications on Aeronautics

Army Air Service and War Department

922 Special Inclinometers and Turn Indicators for Aerial Navigation, 1919
916 Tachometers for Airplanc Engines, 1919
639 Technique of Liaison in Battle, The 1917
*909 Theoretical Courses on Aeronautics for Airship Pilots, 1919 .10
956 Training in Aerial Range Finding, 1919
958 Training in Deflection of Aerial Gunnery, 1919
906 Treatment of Airplane Wing Coverings, 1919
*937 Trouble Shooting for Airplane Engines, 1919 .10
*940 Use of Mechanics' Hand Tools, 1919 .05
912 Utility of Airplane Instruments, 1919
643 Utilization and Role of Artillery Aviators in Trench Warfare, 1917
932 Valve Timing for Airplane Engines, 1919
975 Vickers Aircraft Machine Gun, Model 1918
833 Wing Tip Flare, Mark I—Description of, 1918
352 Performance Test of Navy Vought

Miscellaneous Government Publications

The following is a list of miscellaneous publications relating to Military Aeronautics, published or issued by the U. S. Army Air Service during the World War and subsequently no stock of these exists, this list having been compiled in order that those interested in any particular subject may have at least a reference to copies on file.

A. E. F.

French-English Aeronautic Dictionary, A Practical, Part I & II. (A.S. Information Section).
Manual of Initial Equipment and General Information for Service Squadrons in the Air Service, A.E.F., 1918
Notes on Branch Intelligence (1919) General Staff, A. E. F.
Propellers Approved for Use on Airplanes of Types in Use by A.E.F. Technical Data Section, Air Service, A.E.F., November, 1918.
Ring Sight. Air Service, Training Section. (Lecture by Capt. J. A. Cooper, R.F.C.) A.E.F.
Signal Communications for All Arms (1919)
Silhouettes of Allied and Enemy Airplanes, May 1918
Spare Parts for Airplanes, Lists of:—
A.R. Type I as furnished by the French Government
A.R. Type II as furnished by the French Government
Breguet XIV A2 as furnished by the French Government
Breguet XIV B2 as furnished by the French Government
Nieuport XXVII as furnished by the French Government
Nieuport XXVIII as furnished by the French Government
Sopwith A2—B2 as furnished by the French Government
Spad XI A.2 as furnished by the French Government
Spad XIII CI as furnished by the French Government
Spad S VII as furnished by the French Government
Voisin Type VIII as furnished by the French Government
Spare Parts for Engines, Lists of:—
Clerget 130 H.P. Type 9B Monomotor Airplanes as furnished by the French Government
Gnome 150 H.P. Types 9 NB, NC Monomotor Airplanes as furnished by the French Government
Hispano-Suiza 180 H.P. Type 8-AB Monomotor Airplanes as furnished by the French Government
Spare Parts for Engines (Contd.)
Hispano-Suiza 200 & 220 H.P. Monomotor Airplanes, etc.
LeRhone 120 H. P. Types JBY & JBC Monomotor Airplanes, etc.
Pengeot 220 H.P. Monomotor Airplanes, etc.
Renault 150/170 H.P. Type 8-GB Monomotor Airplanes, etc.
Renault 190 H.P. Monomotor Air-Planes, etc.
Renault 190 H.P. Monomotor Airplanes, etc.
Salmson 9-ZM, H.P. Monomotor Airplanes, etc.

AIR SERVICE, U. S. ARMY

Aircraft Production Facts, by Col. G. W. Mixter and Lieut. H. H. Emmons, 1919
English-French Glossary of Aeronautical Terms, 1918
Instructions for Installation of Type L Cameras on Airplanes, G.P.O., 1918
Notes on Rigging for Air Mechanics, 1917. G.P.O., 1918.
Theory of Ballooning by Griffith Brewer. (A course of Four Lectures on the Theory of Ballooning, delivered before Officers at the Royal Naval Air Station, Roehampton).
Training Manual No. 2, 1917. Gibson Bros. Press Inc., Washington.

BUREAU OF AIRCRAFT PRODUCTION

AC Titan Airplane Spark Plugs—Liberty Engine Service Bulletin No. 4, Nov. 2, 1918. Detroit District, A.S., B.A.P.
Carburetor Air Intake—Liberty Engine Service Bulletin No. 2, Nov. 2, 1918. Detroit District, A.S., B.A.P.
Carburetor Altitude Adjustment—Liberty Engine Service Bulletin No. 1, Nov. 2, 1918, Detroit District, A.S., B.A.P.
Carburetor Gasoline Strainer—Liberty Engine Service Bulletin No. 3, Nov. 2, 1918. Detroit District, A.S., B.A.P.
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14 Gaskets Used in the Bellows (Sylphon) Type Fuel Pump.
15 Calibration of Magnetic Compasses on DH-4 Cross-Country Airplanes.
16 Submitting Samples for Test
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20 Propellers used on JN-4H and JN-6H Airplanes.
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22 Liberty Thrust Bearing Retaining Nut.
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28 Standard Spark Plugs for Aviation Engines.
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31 Reinforcing of DH4 Type Landing Gear Axles.
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6 Liberty Engine—Carburetor. 1 p. (Old Information Circ. #34) (D-52.41/Liberty/201)
7 Liberty Engine—Generator Drive Shaft and Crankshaft Thrust Bearing. I p. (Old Information Circ. #35)
8 Liberty Engine-Timing. 1 p. (Old Information Circ. #36)
9 Liberty Engine—Cam Shaft and Gun Control Housing. (Old Information Circ. #37)
15 Liberty Engine, Order of Major Teardown. (Old Information Circ. #38)
16 Table of Spare Allowances; Maintenance 25 DH-4 Airplanes for 3 mos. (D52.1/DH4/7) See also U-40.
25 The Ruggles Orientator.
27 Flame Resisting Parachute Silk. Hy. A. Gardner. Aircraft Technical Note #93. (Balloon Bulletin #128-a).
40 Table of Spare Parts Allowance for maintenance of 25 DH-4 Airplanes for three months. 6 pp. (D52.I/DH4/7)
41 Table of Spare Parts Allowance for maintenance of 25 JN-4-D Airplanes for three months. 3 pp. (D52.I/Curtiss/31)
42 Table of Spare Parts Allowance for Maintenance of 25 Liberty 12 cyl. Motors for three months. 7 pp. (D52.41/Liberty/202)
43 Table of Spare Parts Allowance for Maintenance of 25 model "I" 150 HP Hispano-Suiza Motors for three months. 18 pp. (D52.-

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31/Hispano-Suiza/89)
44 Table of Spare Parts Allowance for maintenance of 25 model "E" 180 HP Hispano-Suiza Motors for three months. 17 pp. (D52.41/-Hispano-Suiza/90)
45 Table of Spare Parts Allowance for maintenance of 25 Le Rhone 80 HP Engines for a period of three months. 7 pp. (D52.41/LeRhone/52)
46 Liberty 12 Aeronautical Engine, General Description of. 2 pp. (D52.41/Liberty/36)
96 Table of Spare Parts Allowance—Letter, June 5, 1919. (D52.419/17)
97 Air Service Pursuit and Combat Manual. 1919.
98 Program for Air Service Training. 109 pp. (C53.2/50)
99 The Castor Oil Enterprise, Statement Regarding. June, 1919. 24 pp. (A00/25)
135 Canvas Hangars for Balloons—Description and Instruction in Erection. (Balloon Bulletin #98) 1919. 6 pp. & chart. (F34/15)
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254 Mechanical Tests—Definitions and English equivalents of Terms used in Treatment of Steel. Advisory Committee No. 1, 1919. (D61.2/5) (Int. Airc. Stnds. Com.)
255 Chemical Analysis—Methods of Sampling and Analysing Cast Iron for Aircraft. Advisory Committee No. 2. Int. Aircraft Standards Commission. 1919. 4 pp. (D10/-17/3)
256 Tolerances on Bars—Advisory Committee No. 3. Int. Aircraft Standards Commission. 1919. 11 pp. (D10.1/17)
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258 Sparking Plugs. Advisory Committee No. 5. Int. Aircraft Standards Commission. 1919. 7 pp. (D52.413/Spark plugs/26)
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311 Comments on Strength, Organization and Training of the Air Service. Pamphlet No. 12, O. D. A. S. 1919. (C20.3/36)
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370 History and Development of the Air Service. By Major F. P. Lahm. A lecture at West Point, N. Y. 1920. 17 pp. (C21/51)
374 Specifications for Richards Hangars, frame and cover.—Type A. (F34/30 Type A)
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404 The Air Service Overseas—General Development, Operations. 1920. 25 pp. (C21/57)
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U-552 Defense of rigid airship—article by German engineer. (D52.-71/106)
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U-579 Rules for forecasting winds aloft. (A40.01/23)
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Glider Contest

The first international soaring flight competition to be held in the United States between July 10 and August 15 will take place on the Pacific Coast. Oakland, California, has been awarded the meet by the National Aeronautic Association provided the city will raise its offer of $5,000 to $10,000 in prize money to the contestants, San Diego, Calif., is a contender for the competition and besides offering ideal conditions for glider navigation, promises to put up necessary prize money inducements. Capt. E. V. Rickenbacker, premier fighting "ace" of the American fliers in the World War,has donated a valuable trophy for the contest.

The Soaring Flight committee of the N. A. A., Orville Wright, chairman, after considering the claims of many localities for the glider contest, decided that Oakland offered the right conditions at Berkeley, northeast of the city, which has an unobstructed slope of three miles that has stood the test with a glider weighing 510 pounds. Wind and weather conditions at Berkeley average as near perfection as is possible to find anywhere in the country.

German, French and British gliders have promised to enter the American competition. "Few applications for the glider meet afforded right conditions," said Mr. Wright. "A broad, flat surface contiguous to a chain of hills so that the wind is deflected upward, is absolutely necessary. The sides of the hill must be practically free from obstructions, because the gliders take off on high ground and may be forced to descend at any point along the crest of the hill or in the valley. Expert pilots in good gliders are able to select their landing places," said Mr. Wright, "but we must encourage the amateurs, even if their machines are not of the best, by having the face of the hill and a long stretch of valley free from obstructions."

Gliding in Europe

In Germany the regulations for this year's competitions have now been published, the February issue of *Flugsport* being devoted almost exclusively to the forthcoming German competitions.

The Rhön Competition ("Rhön-Segelflug-Wettbewerb, 1923,") will take place from August 3 to August 14. This applies to the main competition. Running concurrently with this will be held a secondary competition for less experienced pilots, and this will last until August 31, while opening on the same day as the main competition.

In the main, the competition of this year follows the lines of those of previous years. The machines, before being admitted, must, in the case of the main competition, make a glide of at least 0.6 km. (0.37 mile), or of a duration of at least 60 secs. For the secondary competition, the corresponding figures are 0.15 km. distance or 15 secs. duration for machines controlled by shifting the weight of the pilot, and 0.3 km. or 30 secs. for machines controlled by flaps, elevators, and rudders. In addition, competitors must satisfy structural experts appointed by the organizers as to the strength of their machines.

The preliminary competition is for pilots who do not hold a pilot's licence for power-driven machines, but who do hold the licence A issued by the German Model and Glider Society (Deutschen Modell- und Segelflugverband). For the main competition, pilots who have no certificate for power-driven aeroplanes may be admitted by a test of 60 secs. duration, during which two quarter-turns must be made, one left-hand and one right-hand. Holders of the class B certificate of the above mentioned Society are also admitted.

It is of interest to note that the Rhön competition will be open to other than Germans, although such admittance is confined to subjects of countries in which Germans are not debarred from taking part in competitions.

The Great Rhön Soaring Prize (Grosser Rhönsegelpreis, 1923) in the main competition will be awarded to the pilot who covers, in a single flight, the greatest distance in a straight line, with a minimum of 12 km. (7.44 miles). This prize is to the amount of one million marks. The first pilot to fulfil the minimum condition (12 km.) will receive 10 per cent. of the prize and each succeeding competitor who exceeds the previous distance by 5 km. will receive 5 per cent of the prize, these amounts to be deducted from the main prize secured by the ultimate winner.

First, second and third prizes, amounting to 300,000, 200,000 and 100,000 marks respectively, will be awarded for heights attained above the summit of the Wasserkuppe. The minimum height to be attained is 350 metres (1,150 ft.).

A third section is for distance covered in a straight line, open to all machines, with the exception that the machine and flight which win the great Rhön Prize do not count for this one. The flight will include taking into account loss or gain in height, as well as the actual distance covered, the following formula being employed:—

$$E = E_o - 8\,h_v + 12\,h_g$$

in which E is the distance figure on which the award of prizes will be based, E_o is the actual measured distance covered (in metres, presumably), and h_v and h_g are the figures representing loss and gain in height respectively (presumably in metres). The formula appears to work in the following manner. If a glide of 10 km. were made, and no account taken of loss of height, 10,000 would represent the figure on which the award was based. If, however, the machine dropped 1,000 metres during the flight (it does not appear that these figures refer only to the height of the alighting point, but to heights and "depths" reached *during* the flight) and at no time got up higher than its starting point the figure would be 10,000—8,000=2,000. If, during the flight, the machine reached a height of 500 metres above its starting point, the other figures remaining as before, the value of E would be 10,000—8,000+6,000=8,000. Presumably, the highest and lowest points reached count, so that if a machine does not drop below the point at which it ultimately alights, the height of that point will be the figure taken. Barographs are to be carried, and the gains or losses in height will be taken from their readings. The prizes in this section are 300,000, 200,000 and 100,000 marks respectively.

In the preliminary, or secondary, competition there are four groups of prizes, each of 120,000, 100,000, 80,000 and 60,000 marks for first, second, third and fourth prize. The competitions are divided into two sections, according to whether or not the pilots are holders of a license for motor-driven aircraft. The awards are the same in both classes, and the main divisions are for total flight duration and for duration in a single flight.

Herr F. J. M. Hansen, of Cologne, the designer of the Statax engine, has offered a prize of 100,000 marks for the first man to make a triangular flight of 45 km. side in a glider fitted with auxiliary engine. As a glider is considered any aeroplane which has remained up for a minimum of 10 minutes without motor power, the machine may have had an engine on board, but this must have been stopped previous to the timing of the 10 minutes glide. The engine used may be any petrol motor, not exceeding a capacity of 600 c. c. Two assistants will be allowed for starting, so that presumably there is no objection to the machine being started off from the top of a hill by rubber cords. Once in the air, however, it will have to proceed on its 84 miles flight without any other assistance than that which may be afforded by rising currents, gusts, etc. It seems likely that several of the machines competing for this prize will be fitted with the Statax motor described in our issue of November 23, 1922, which is within the cylinder capacity stipulated and is very light, weighing but 18 lbs., and developing 7.5 h. p.

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(*Concluded from page 285*)

cial, industrial, legal and aviation experts" that shall "examine the steps practicable, both immediately and subsequently, to promote international development of civil aviation for commercial purposes." This advisory committee is to "maintain touch with any national or international organization concerned with air navigation so as to insure the closest collaboration, and that it exert means at its disposal to increase the interest of financiers and business men in this subject."

In presenting as a business man the view of forward-looking business men throughout the world relative to expediting communication and transportation for the advancement of commerce, Mr. Coffin emphasized the vital concern of all as patriotic citizens in the important questions touching the national security and welfare. "Aviation," he declared, "is the one outstanding mechanical heritage of the World War destined to influence for good the future relationships of mankind. Through aviation has come the realization of that dream of all ages, the conquest of the air and the conversion of this final and most baffling medium to the purpose of civilization as the speediest means of communication and of trade."

The difficulties of the commercial application of this new art were recognized said Mr. Coffin, but he asserted they would be overcome and in the end promoted hy the demand of human-kind for a faster and more luxurious form of travel and transport. "Aviation," he said, "more than any other form of transportation is essentially international in character. The channels of operation lie through the free spaces of the air where movement is unhampered by political, artificial or natural barriers." No limitation is placed upon aviaton by frontiers, mountain ranges, oceans and rivers, or even continents, he declared, so that "if the slower forms of transportation have influenced civilization greatly and contributed to the welfare of nations, the benefits of commercial air navigation may be assumed beyond question."

Pointing out that aviation has forced the immediate need of a new code of procedure, of admiralty laws of the air, Mr. Coffin said: "In the realm of national defense no country can in future be secure against aggression unless it controls the air spaces above its territory. The creation and maintenance of the necessary air defense by nations is now inevitable. Now, whether this air defense is financed by direct appropriation sequestered from commercial activity and thereby lost to the constructive purposes of national life, or whether it is founded in large part upon the development of a commercially profitahle civil aviation in the form of a 'merchant air fleet' may well engage the sincere attention of chambers of commerce of all countries."

Speaking for the American delegation, Mr. Coffin continued: "While for reasons of sound economics we favor the maintenance of adequate defensive machinery by each nation, we have certainly cast our influence against the excessive withdrawal of men and money from fields of production and trade. There is no doubt that air warfare has of itself put certain practical limitations upon both land and naval armaments, but no adequate effort has yet been turned to the limitation of the general direction of aviation as an offensive or defensive asset among nations.

Concluding with the endorsement of the support and approval from the American delegation of the recommendation that national funds be utilized to create a permanent and self-supporting civil air transportation, the congress without a dissenting voice adopted the resolution amid applause from delegates and spectators. The sub-committee which reviewed the world situation relative to commercial aviation and drafted the resolution was composed of Col. Frank P. Lahm, U. S. Army; Louis Breguet, France; H. James Yates, Great Britain; Col. Pier Ruggero Piccio, Italy.

(*Concluded from page 279*)

Council in any case in which an entrant obtains the consent of the Air Council to the test of the entrant's machine being held at some place other than that originally appointed by the Air Council) must be borne by the entrant.

18. Flying machines entered for the competition will at all times be under the charge and control of the entrant, and no liability will be accepted by the Air Council for injury or damage to person or property caused to or by the entrant of any machine or any person or persons having an interest in the machine or his or her servants or agents in connection with the competition.

19. The prizes in connection with the competition will be as follows:

Suhject to and in accordance with the Conditions of the Competition:-

(I) A sum of £5,000 will be awarded in respect of test (a) named in Condition 4.

(II) A further sum of £15,000 will be awarded in respect of tests (a) and (h) named in Condition 4.

(III) A further sum of £20,000 will be awarded in respect of tests (a) and (c) named in Condition 4.

(IV) A further sum of £10,000 will be awarded in respect of tests (a) and (d) named in Condition 4.

20. The prizes named in Condition 19 will be awarded to the entrants of flying machines which are submitted for test in accordance with the conditions of the competition at the appointed time and place and which successfully and to the satisfaction of the Judging Committee appointed by the Air Council carry out the tests specified in the presence of and under the direction of the Judging Committee.

21. In the event of two or more flying machines successfully and to the satisfaction of the Judging Committee appointed by the Air Council carrying out any test or tests for which a separate prize is allocated under Condition 19 (I), (II), (III), and (IV) the prize allocated for such test or tests will be divided equally or in such proportions as the Judging Committee may determine hetween the entrants of the successful machines.

22. The Air Council shall not be bound to recognise any claim right or interest of any person or persons having an interest in any flying machine entered for the Competition other than the entrant of the machine and the receipt of the entrant shall be a sufficient discharge for any payment made by the Air Ministry in respect of any prize or share of a prize awarded.

23. No part of the above mentioned prizes will be awarded in respect of the helicopter now being constructed by Louis Brennan Esq., C. B. for and on behalf of the Air Council.

24. In the event of any of the prizes not being awarded such prize will again be offered for competition within a further period of one year from the date of the announcement by the Air Council of the result of the original tests upon terms to be then announced.

25. All communications in respect of the competition should be addressed to the Secretary, Air Ministry, Adastral House, Kingsway, London, W. C. 2.

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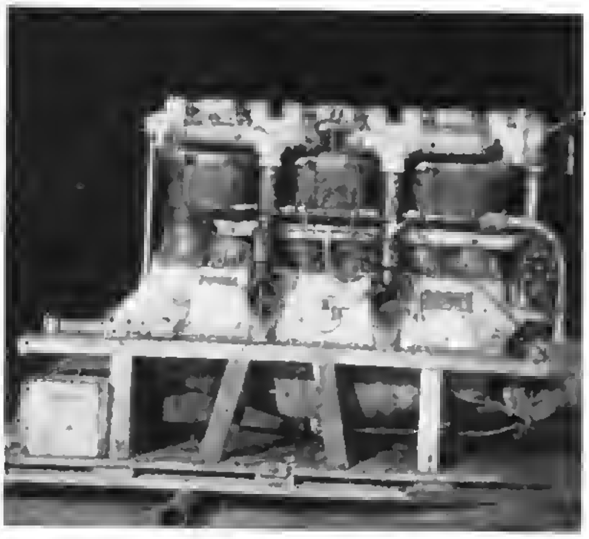

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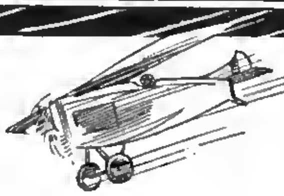

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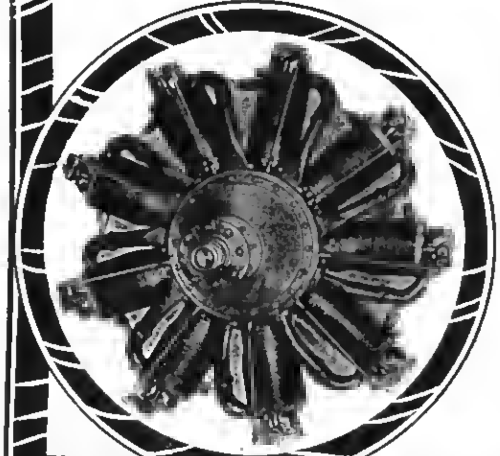

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TABLE OF CONTENTS

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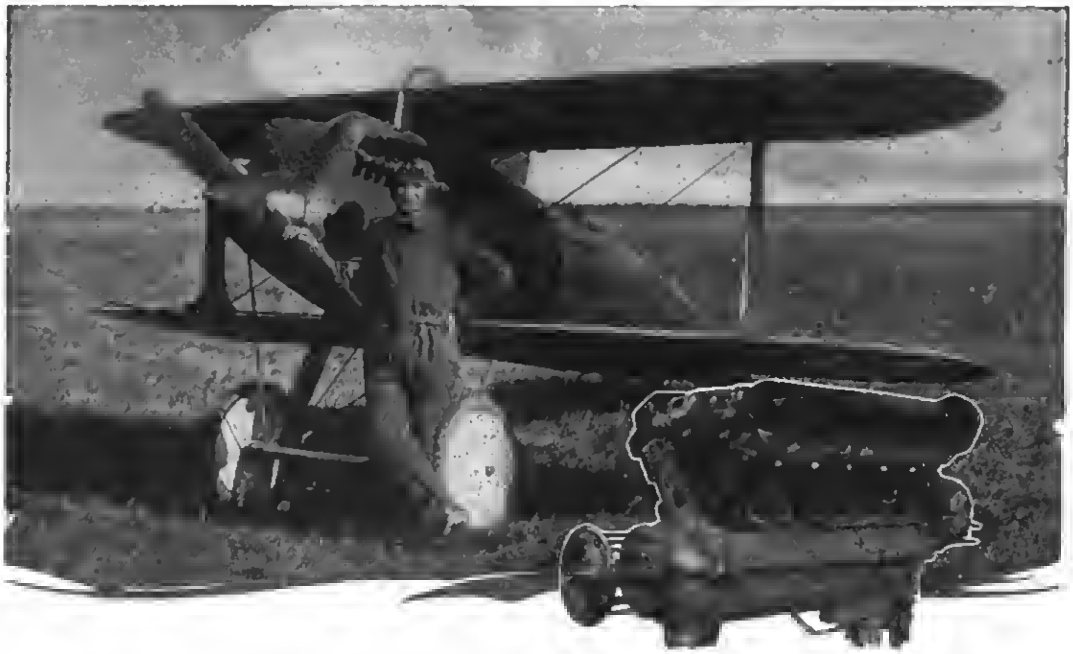

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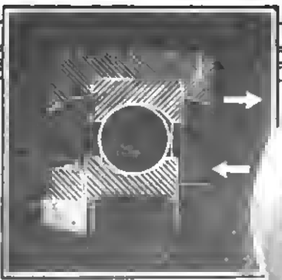

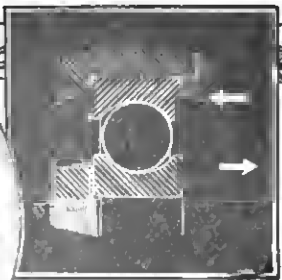

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AERIAL AGE

With which is consolidated
Flying

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WHAT sort of criterion have we at present for predicting the performance of an airplane before building it?

We have wind tunnel tests, of course, which are the only semi-scientific and semi-reliable sort of guidance that we can follow in the preliminary stage of the design of aircraft. We all know the many practical objections to wind tunnel tests which are reliable only if........and a good many ifs could be mentioned here.

Calculation is another method.—However, calculation in this case is a function of so many design elements that in order to find out the influence that the change of one of them has on the results, we must go through a long process of calculation, the outcome of which we fail to see at a glance.

A simple graphical method that would allow the designer of an aircraft to know at a glance what is the calculated performance of an aircraft in function of half a dozen or more variables entering in the project of a flying machine, would certainly be a very useful contribution to the development of aeronautics.

There are a number of graphical methods at present that can be used as a sort of rough guidance in the design of aircraft. None of them, however, is complete and none of them is based on a sound aerodynamical theory.

NOWADAYS, when every patron of aeronautics is willing to put up a cash prize for a trophy for a race, or for a model building contest, we would be glad to see somebody put up a $1,000 cash prize for a good, simple and reliable graphical method for predicting the performance of an aircraft when the design data are given.

A contest of this nature should be open to everybody in the United States and outside of the United States and the cash prize should be awarded to the originator of a graphical method of calculation based on sound aerodynamical principles. The results thus calculated must check up closely with the actual performance of a new type of aircraft which must be built and tested after the competition has been closed.

In our estimation, the thing could be managed this way:—One of our aircraft manufacturers designs a new type of aircraft, which he intends to build:—The dimensions and design characteristics of this new aircraft are used as a basis for issuing the competition: —A model of this aircraft is built and is tested by the National Advisory Committee for Aeronautics:—The competitors for the prize submit their graphical methods to the National Advisory Committee for Aeronautics and after the aircraft is built as closely as possible to the initial project it is also turned over to the N. A. C. A. which will test it and will award the prize to the winner of the competition.

This procedure would allow us to compare the results obtained from the best graphical method submitted by experts all over the world with the actual performance of the aircraft in flight, and furthermore, would allow us to compare both results with a wind tunnel test on the aircraft model.

There is no question about the great usefulness of such a competition. The question is—who is going to put up the $1,000 cash prize? Why not the aircraft manufacturer who designs and builds the aircraft tested? Why not the Aircraft Manufacturers' Association? Why not the National Aeronautic Association?

NIGHT flying is rightfully considered as the primary condition that must become an established everyday fact before commercial flying over long distances can successfully compete with the express train which can travel day and night.

This is quite true and we agree with the advocates of night flying that this must eventually be done. We cannot, however, agree with a good many impatient futurists who believe that all that is needed for establishing night flying is the building of a few light houses along the air routes.

Last February, a night flying test was made over the Paris-London line by a DeHaviland type G equipped with a Siddeley-Puma 240 HP motor and weighing 4,000 pounds. The maximum speed of this aircraft is 110 miles per hour and the landing speed 50 miles per hour.

The test was made under particularly severe conditions considering the weather at this time of the year over the British Channel. However, the results were not very brilliant. Of 24 scheduled trips between February 5th and 28th, only four could be completed,

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thus giving a percentage of only 17 per cent successful flights.

To fly in clouds in daylight is only disagreeable, but to fly in the clouds during the night is a more serious matter. Those who have been at sea on a fast moving ship and have suddenly found themselves in a thick fog in a pitch dark night know what this means.

However, while the stability of a ship in the water is assured, at any time, independently of the pilot, the stability of an aircraft in the air is entirely too much dependent upon the human equation represented by the pilot. This is true both in day and night flying; in the latter case, however, the matter is complicated by the additional strain on the pilot and consequently the probability of accidents are greatly increased.

Before we can have safe night flying, and as a matter of fact, before we can have any sort of comparatively safe flying, we must design and build an automatic stabilizer which will reduce the importance of the human factor in the performance of aircraft.

The development of a suitable automatic stabilizer will contribute more to the development of commercial flying than anything else that can be done at the present time in this direction.

Who is going to develop it?

THE article, printed elsewhere in this issue, on the status of aeronautics in France, will give everyone, who has the interest of American aeronautics at heart, food for thought. If a debtor nation can make such rapid strides as is indicated in M. Flandin's article, surely a nation with the resources of the United States can more rapidly utilize the advantages of commercial aeronautic development.

Col. G. Arthur Crocco Becomes A Member of the Editorial Staff of Aerial Age

AERIAL AGE is glad to announce that Col. G. Arthur Crocco, the well-known Italian aeronautical expert and an authority on dirigible construction, has been appointed Associate Editor of Aerial Age.

In 1903, Col. Crocco presented to the French Academy of Sciences a note on the stability of dirigibles, in which was given for the first time the basis for the calculation of the stability and damping effect of dirigibles. A gold medal was awarded by the French Academy of Sciences to the author, who later extended his method to heavier than air aircraft and published the first complete and original theory on "The lateral stability of airplanes."

In order to verify experimentally his theories, Col. Crocco built an aerodynamic wind tunnel and a Froude water tank, and later on founded the Central Aeronautic Institute in Rome, which is one of the best scientific research institutes in aeronautics in Europe.

Col. Crocco is the author of the well-known analytical theory on propellers, and he has been the first one to establish a rational basis for the aerodynamics involved in the operation of propellers. An application of his theory was made by the author when he designed and built the first variable pitch propeller for dirigibles and when he invented the breaking device for helicopters when landing without motor, which has since been adopted by Pescara in his helicopter.

In hydroplane construction also, Col. Crocco is a pioneer. In fact, the experiments made by him with the collaboration of Col. Ricaldoni and Col. Munari, and with the financial support of General Morris, on a hydroplane designed by him and a modification of the Forlanini design, were considerably in advance of similar experiments made by Graham Bell in the United States twelve years later.

During the war, Col. Crocco designed and built an automatic focusing device for guns operated on board of dirigibles, and with the collaboration of Col. Guidoni designed and built the *telebomba*, which is the most effective aerial torpedo so far produced. He is the inventor of the first automatic stabilizer for aircraft, and also of the first route indicator.

Col. G. Arthur Crocco

In spite, however, of the important work done by him in the scientific field of aerodynamics and in the engineering field of aeronautics, Col. Crocco is primarily an expert on dirigibles. In 1907, always with the enthusiastic support of General Moris and with the collaboration of Col. Ricaldoni and Col. Munari, he built the first Italian semi-rigid dirigible with automatic rudders. During the war he really created a lighter-than-air industry in Italy and built thirty dirigibles.

After the war, in collaboration with Usuelli and others, he built the "Roma", and has since established the basis for the development of the semi-rigid type, of which he is the most authoritative exponent.

Col. Crocco is also the author of a project for a rigid type of dirigible which has been responsible for a number of improvements in both British and German rigid dirigibles in which some of his ideas have been incorporated. We consider it a great privilege to have Col. Crocco on our editorial staff and we extend to him our cordial greetings.

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The Observer's Column

America is taking up metal construction with a vengeance. There was Larsen and his J-L, the Wright company has filed an exhibit with the Navy, and now a new center of activity comes out with another example of home-grown products. When the observer came around, the fuselage was all made up nice and shipshape the engine had been installed and under the bow was stuck a piece of timber to take off any undue strains on the members while resting on the ground. But during lunch one day, so the story goes, somebody having taken away the scantling, the hull darn engine and mount fell through.

I don't know what this story illustrates, but it's a good story. The flying field needed another hangar so the engineers got together and worked out the stress diagrams and the movement of the c. of p. and the location for the bar and finally got the thing all up.

And when they had it finished, sure, it looked so sweet and fair,

"Suppose we take a DH, and put the old thing there."

The plane stuck by about two and a half feet, more or less, over and above the scheduled tolerance. "Oh well, isn't this an experimental field?"

Bolling Field is to have a new K. O., Maj. Wm. H. Garrison, Jr., Air Service, who will take command some time in June when he finishes his course at General Service School at Fort Leavenworth. Maj. Garrison was an officer of the Volunteers in the Spanish War, became a cadet at the Point and commissioned 2d. Lt., Cavalry in the regular establishment in 1908. He was made a temporary Major in 1917 and later commissioned permanently in his present rank. He is an airplane pilot, having learned to fly at Brooks Field, San Antone, in 1918.

Normally, a change in station isn't of importance to the majority of readers but Bolling Field is an exceptional field. Here it is that the Congressmen—Gawd bless 'em for the Volstead act—take their and their secretaries' rides, and the Chief of the Air Service flies and Admiral Moffet and where the manufacturers show their new machines, and so on.

Maj. B. Q. Jones, Commanding Officer of the U. S. Army Air Service in the Philippines has rather a unique way of saying things. He usually has something worth while to say, too, and knows how to say it. He's snappy and fast with the paper work and we like him. He used to say words were invented for the expression of ideas and if we claimed we didn't mean just exactly his opinion of what we said, he told us to say what we meant, then.

Well, anyway, B. Q. says that any airplane on his field that's fit for anyone to fly is fit for the C.O. No private planes for him. And he claims to be able to fly any plane on the field.

There's 600 plus expendable Second Lieutenants in the Air Service Officers Reserve Corps for every Colonel, and there's 10 Colonels, 20 Lieut.-Colonels, 152 Majors, 650 Captains and 1314 First Looies.—8165 in all, including 19 extra Second Loots left over from the ratio first-above mentioned.

The regular Air Service establishment numbers 873 souls commissioned in that arm. The Second Looies here number but 74 and the Firsts 556; 139 Captains, 88 Majors, 12 Lieut.-Colonels, 2 Colonels, 1 Brig.-General and 1 Major-General. Only 11 are non-flyers. Thirty-nine are flying but are not yet rated as either military aviator, airplane pilot, airship pilot, airplane observer or balloon observer. Brig.-General Mitchell and 3 Majors are now the only "military aviators"—the oldest rating in U. S. aeronautics. Airplane pilots number 707, of whom 67 are airplane observers in addition; and airplane observers total 9 (count 'em). Airship pilots number 50, all balloon observers as well. There's Jimmy Healey and 52 other balloon observers. On duty, but not a part of the Air Service, are some 40-odd flight surgeons.

The Wright all-metal pursuit plane has attracted a lot of favorable comment in Washington flying circles.

France has entered upon a realization of air supremacy. Her air forces are now four times larger than the air forces of Great Britain. She is now in world command of the air.

Gnome company, has purchased the French rights for the British air cooled radial engine of the British company. In *Aerial Age* for May it was argued by Lieut. Leighton, USN, that a 400 h. p. air cooled engined power plant would weigh 940 lbs. against the 400 h. p. Liberty's weight 1462 lbs.

France is following Germany in the development of all metal construction. Junkers is convinced that the metal plane, built of duraluminum, has great advantages for peace time flying. It is claimed for metal construction that passengers are not injured in crashes, that there is less depreciation, that the fire risk on crash is less. Ease of construction is another advantage. In crashes the members bend and twist but do not splinter.

According to the Army Air Service the Fokker monoplane used by Macready and Kelly in the new records takes 1 mile to get off with full load and 1 hour to climb 4000 feet. Spencer Heath says: "Tell 'em a universal propeller will take 'em off in 1400 instead of 5280 feet and will climb the 4000 feet in about 35 minutes instead of an hour."

Detroit is to have an air board. Brig. Gen. C. Godloe Edgar, chairman of the committee on organization, said that the board woud aid in:

1. Development of the science of aeronautics, including the design and use of aircraft, both lighter and heavier than air.
2. Application of aeronautics in all of its aspects to the National defense.
3. Development and organization of governmental agencies for the administration and control of commercial and civil aeronautics for the well being and safety of the general public.
4. Development of the jurisprudence of the air by which aeronautical transportation will be given a recognized position in the affairs of the country.
5. Development of the use of aircraft for purposes of commerce and facilities for making commercial transportation practical and a business possibility.

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France—Mistress of the Air

Germany's Commercial Airways a Potential War Risk -- Commercial Aircraft the First Line of Defense -- Gas Bombs and Airplanes Make Stupendous Rifles -- French Appropriations Smallest but Greatest in Results -- America Outstripped by Smallest Nations -- The Sick Man of the East is Getting Well by Air

FRANCE leads the world in air transportation. This commercial application of the airplane keeps alive her factories, among which orders are widely distributed in order to nourish as large an industry as possible. The technical progress essential for the improvement of commercial air transport is just as essential for the development of aeronautics as a means of national security —defense if you prefer. Her military air force is now four times larger than that of England. This, added to her commercial possibilities, gives her world command of the air.

France has reason to be interested in air defense. Her late enemy, by whom she has been invaded every fifty years since before Christ, is but three hours away from her capital. The Versailles treaty hasn't disarmed Germany in the air. It is estimated that Germany today could equip an air force of 5000 airplanes during a "period of diplomatic tension" lasting eight or nine months. It is figured that at least seven months are needed by any nation to inaugurate an intensive manufacture of aircraft and their engines.

Pierre Flandin, a member of the Chamber of Deputies of France and head of the Aero Club de France, draws attention "to the fact that hereafter it will be possible to load on a single airplane (and he means everyday, commercial craft such as France and Germany and Sweden, Turkey, Denmark and Africa and other advanced nations, save America, are operating daily in passenger and express lines—*Ed.*) a complete section of machine guns, including personnel, material and supplies. Imagine a moment what three or four hundred sections of machine guns could do in the three hours following the opening of hostilities by landing suddenly near the most delicate points in the general organization of a nation. During several hours, at least, each one of these sections will be the complete master of a small portion of the territory which it occupies—stations, railroad bridges, dams, harbors, large factories, etc. While the machine gun is on guard, the destruction section will operate, and one must remember the formidable possible development of chemical warfare."

How much of the resistance of a nation could be broken in a few hours by an aerial force supplemented by another air force working on the morale of the population by the systematic bombardment of great cities, will be measured in the next war, wherever it occurs. Here is the first line of defense. Two can play at this same game. The country with air supremacy is doped out to win—at least, it's certain she'll be first away at the barrier.

The 200-pound bombs of the world war now give place to those of 2000 pounds. This weight of gas out-effects the same weight of high explosives. True, the late conference on the limitation of armaments signed something about using gas within the conference family, but the members are free to use it against the heathen non-members or inside the family if someone renegs. And the gas-carrying airplane has the long-range gun outranged by a hundred miles. Then there is the enemy's navy which may be reached by the suddenly drafted commercial airplanes—all providing the enemy doesn't do the same thing.

However, each country appreciates the airplane and airship and the one with the quickest, heaviest and longest punch is the one which will land first.

This means a race for aerial supremacy.

Facing the risk of Germany's quick change from commercial planes to those of war, France feels her only guarantee of safety is in the air.

M. Flandin, at the same time, wants it clear that it would be unjust to accuse France, because she is making such a great effort in the establishment and maintainance of her network of air transport routes, of embarking upon a course of aerial imperialism. He compares the respective budgets of England, the United States and of France to show that the two Anglo-Saxon nations devote more money to aeronautics than does France.

"Reducing all these credits to dollars and adding to them, it being well understood, all other expenses chargeable to military, naval or civilian aeronautics, we arrive at the following figures for 1922:

For Great Britain.....	$72,000,000
For the United States..	40,000,000[1]
For France...........	32,000,000[2]

"We are not then building an aerial fleet with the money which, although certain opinion suspects it, we should, it is said, devote to the payment of our debts. We are simply assuring our national security, working above all for the peaceful progress in the development of commercial air locomotion.

"We are proud to have been the originators of this movement and we are convinced that the day when the system of air transport extends over the entire world, facilitating understanding between peoples, and above all personal relations with the elite of all nations, we will have worked in the most efficacious manner to establish world peace, for nothing is so valuable as a direct contact of individuals in dissipating the misunderstandings and the ignorance which often separates nations, particularly when they are widely separated from each other."

Admitting that the main reason for the establishment of French air routes is political; that because of short distances, necessity for frequent landings for customs, the operation of lines to points which produce little or no revenue, where a strictly non-sub-

[1]The combined appropriations for Army and Navy Air Services, Air Mail and National Advisory Committee for Aeronautics for fiscal year 1922 was $34,063,431; for fiscal year 1923 was $29,493,590; and for 1924 was $28,843,174. Army and Navy figures include field civilian personnel but not pay of officers, enlisted men and departmental civil employes. P. O. figures include pay of air mail personnel and expenses of operating. NACA item includes pay of employees.—*Editor.*

[2]In considering the reduction of the various sums to dollars, there should be considered the actual purchasing value of the franc and the pound in munitions of war and the current rates of exchange. It has been suggested that the franc may be estimated at two and a half times its exchange value in the purchase of air material. This would, if true, change the French investment to $80,000,000 in reality.—*Editor.*

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sidized commercial line would not fly, the lines are unprofitable from a money standpoint; that the Government pays 60 per cent of the expenses; the actual commercial possibilities are obviously being realized when we consider that over 582 tons of small express were carried last year by French air lines, and more than two million letters were sent at a triple postage rate and 14,397 persons were carried.

And the carriage of merchandise is increasing faster than the carriage of people. The passengers flown in 1922 were only 1 1/2 times those carried in 1921 but the goods transported increased over three times.

America, the land of the Great! Great distances, great cities, big business, the chosen land for air transport, splendid in its aerial isolation. An industry depending on military aircraft only for its existence with a greater field left untilled. And once they praised American genius and progress. Turkey is doing business by air. America looks complacent and buys a ticket on the Broadway Limited, while the puny nations of the earth are flying to work. Shades of Robert Fulton!

Facts and Figures on Commercial Air Traffic in France

. BY PIERRE FLANDIN, PRESIDENT OF THE AERO CLUB OF FRANCE AND A MEMBER OF THE CHAMBER OF DEPUTIES OF FRANCE

Costs—Incomes—Regularity—Safety—Volume of Traffic—Air Traffic on the Increase —May Be Cheaper than Steamship Travel but Dearer than Railroad—Subsidies Diesel-Type Engines Needed—France now "Mistress of the Air"

France has built the nucleus of a great system of air transportation which will bring together the nations of the earth through personal contact. World peace may result from this closer communication and better understanding. In the meantime, in addition to demonstrating the practicality of air transportation France is building national security by air and maintaining an industry. Here is what M. Flandin had to say to the American Club.—EDITOR.

IMMEDIATELY after the war the question arose: Is our magnificent effort in the perfection of technical aeronautics limited to war purposes or may it be applied to peaceful pursuits—in civil and commercial air locomotion?

Three essential questions had to be answered by experience in order that a solution of this problem of commercial flying might be reached.

The first was a question of the *safety* of air transportation. This is attested by the fact that 3,543,000 kilometers were flown by commercial airplanes, in 1922, over French commercial air lines with but three accidents recorded.[1]

The second question was that of the *regularity* of air transportation, i. e., the practical demonstration that a journey by air could be completed within a specified time with the same exactitude as it could by other means of transportation, such as railroads. Experience has demonstrated conclusively that air transportation is as reliable as ordinary modes of travel. For example, this regularity was 98% upon the French lines running into Morocco.[2]

The third question was that of *probable traffic*. The answer to this question may be found in the following tabulation:

[1]*It was stated in the Chamber of Deputies on Nov. 30, 1922, that in the first 11 months there had been 8 accidents in which 18 persons were killed and 3 injured.—Editor.*

Year	Kilometers Flown	Number of Passengers Carried	Kilos. of Express Carried	Kilos. of Mail Carried
1920	853,000	1,379	48,100	3,925
1921	2,353,000	9,427	166,490	9,481
1922	3,543,000	14,397	529,664	41,173
1923	*4,600,000*[3]			

This last figure (41,173 kilos. of mail) represents more than two million letters upon which the senders paid a postal surtax of at least three times the ordinary postage charge.

The increase of traffic is considerable, and it is undoubtedly true that we have not yet arrived at the peak of the curve and that the traffic will continue to increase. These results show that air transportation has found a serious freight to feed it.

I draw your attention particularly to the remarkable development of the carriage of urgent package mail which is becoming an extremely important source of income.

Can it be said that these receipts are sufficient to permit air transportation to develop freely and by its own resources without the financial aid of the State?[4]

No. For, summing up, the total of the commercial receipts for 1922, which were nearly 7,000,000 francs, corresponds to a commercial return of but 2 francs per air kilometer. Now, we must consider that the net cost of transportation per ton-kilometer is from 16 to 18 francs.[5] Our English friends, who recently charged a technical commission with the study of this question, have arrived at a figure, it is true, slightly lower—at the present rate of exchange 13.25 francs per ton-kilometer.

We believe, however, with the experience which we have had on lines extending great distances from their bases of supply and maintenance, that this figure is too low. One must not compare, therefore, without reservation, the cost per ton-kilometer with the receipts per air kilometer which I have just mentioned, for this figure was obtained by airplanes, the greater number of which transported but 500 kilos. of useful load.

The difference between the net cost of transportation, on one hand, and the commercial receipts upon the other, is shown to be less. Putting the matter in a better way, we can not, at present, do more than hope that the commercial receipts may cover one quarter of the operating expense.

[2]*The regularity of the U. S. Air Mail for 1922 was 95.52% of scheduled trips. The average for five years 90.39%. In August, 1922, it was 100%.—Editor*

[3]*Estimated by the Editor.*

[4]*The sum appropriated for subsidies in 1922 was 45,382,000 francs normally equol to $9,076,400.*

[5]*Taking 17 francs per kilometer as an average expense, the cost of operation was 60,231,000 francs for 7,000,000 francs commercial income, which is about 11.6% of the expense; in 1922.*

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Does this mean that one must despair of balancing receipts and expenditures of air transportation, and that State subsidy must remain indefinitely a necessity? I do not think so.

Beyond question, in spite of the development of the traffic, the majority of the lines operated last year at half capacity.[6] If for each trip a full load had been carried, one could have hoped that the commercial receipts would have attained nearly 40% of the operating expense. May one believe that the remaining 60%, today compensated for hy State subsidies, may be reduced in the near future? For my part, I am persuaded of it.

If I may refer to the studies which have been published by the Civil Aviation Advisory Board in England, as well as to the studies which we have made in France, we may separate the elements of net cost per ton-kilometer as follows:

Fuel	24%	
Personnel	20%	
Amortization and maintenance of material	30%	
Insurance ...... (of which 13% is carried on material)	18%	
General expenses and commercial publicity	8%	100%

It is certain that 30% for amortization and maintenance of material represents a formidable proportion, which is due to the fact that the construction of airplanes and, above all, of engines, has not attained to date a sufficient degree of perfection; but we may soon hope, thanks to the general tendency towards metal construction of airplanes and the improvement in the manufacture of engines and a better system of inspection and maintenance of material, that the amortization and maintenance may be reduced one half.

The cost of fuel, represents almost one quarter of the actual cost per ton-kilometer. We can, without doubt, hope that oil-burning engines using a less expensive fuel will one day replace the gasoline engines in use at present. However, in my opinion, this day is still far off and I await a more rapid improvement due to the increase of load in ratio to the horsepower utilized. For example, if I transport five passengers in an airplane driven by a 300 h.p. engine, I use 60 h.p. for each passenger; if I am ahle, with the same 300 h.p. engine, to carry ten passengers, I use but 30 h.p. per passenger and thus reduce by one half the fuel cost. This seems to me to be possible very soon.

This practical problem has been and is very attentively studied by the Germans. They were forced to this by the restrictive clauses imposed upon their aviation, but they also understood that it is a vital problem for the future of commercial air transport.

Finally, it is not to be doubted that, with experience in air transport, other expenses may be equally reduced, as well as the insurance charges which are based upon the cost of the material. We may then hope that the cost per ton-kilometer will be reduced in a few years to 8 or 9 francs instead of 13 to 16 francs as at present. When this result has been attained, counting each passenger with his handbag at 100 kilos., we arrive at a cost of 80 centimes to 1 franc per kilometer. It is worth while to compare this figure with the rate for French *trains de luxe* which is 37 centimes per kilometer; and also with the rate for steamship transportation—for example, from Marseilles to Bombay, which is 1.25 francs per kilometer. It is equally interesting to compare this cost with the actual air transportation rate between London and Paris, which is 80 centimes per kilometer, with a constantly increasing number of passengers. The swing in time realized permits us to state that this rate of 80 centimes per kilometer is not excessive as far as the passenger is concerned.

From this moment, air transport companies will be able to exist without the financial aid of the State. These enterprises will balance their budget still more rapidly if the air mail is generalized. Let us not forget that the weight of 100 kilos. represents 5,000 letters of 20 grammes each, average weight. Upon a route like that of the *Malle des Indes* our English friends estimate that a surtax of one shilling per letter would be willingly paid by the sender, which would represent a commercial return of 2 francs per kilometer for each 100 kilos. of letters over the total distance of 7,000 kilometers.

From now on, we may, then, consider that, due to the improvements which I have just mentioned, an air route between London and India could operate without subsidy and give an appreciable commercial return. In fact, the weekly total of mail between London and India is 150 tons, of which 10.5 tons are letter mail. Returning from India to London, the mail is less heavy; but counting only upon 20% of the letters going by air mail, each airplane could carry daily 300 kilos. of letters, which means 45,000 francs in commercial receipts. If the airplane is of the type actually generalized, i. e., carrying 1 ton of useful load and 4 comfortably arranged passenger places, counting only 3 out of 4 of these places being occupied at 10,000 francs each, a supplementary receipt of 30,000 francs is realized.

There will remain, in addition, transportation for light merchandise and newspapers, a weight of 300 kilos. This last transportation shows great importance between Paris and London and is sufficiently remunerative, constituting, in consequence, the profit of the company, the operating expense being covered by the first two items.

These calculations seem sufficient to justify the confidence which the public officials and the French aeronautical world have in the future of air transportation. They are, in addition, a justification of the sacrifices which the State has made to aid air transport companies to live. I know that in certain quarters, and notably abroad, there has been criticism of the French Government for the amount spent in the development of air locomotion, but I desire to state, in conclusion, that these sacrifices which are founded upon the possibilities of the future, have also their reason from the point of view of the national defense.

[6]The figures on income in this article can not be taken as indicative of what may be expected in America. France is operating lines between places where travel, mail and express is small in amount, for political or military reasons rather than for commercial returns. Commercial lines in America will follow the volume of traffic. —*Editor*

Navy Personnel Situation Will Affect Naval Aviation

Recent communication from the Bureau of Navigation calls attention to the fact that there will be an increasing shortage of personnel in the Navy for the next six months due to the excess of expirations of enlistments during that period over the normal rate. It is estimated that at the end of the calendar year the Navy will be from 8% to 10% short of its authorized complement. In spite of the fact that this shortage has been progressive of late, Naval Aviation has been generously dealt with. At the present time there is an excess of 400 men in the combined aviation units. During the next six months Naval Aviation will be required to reduce so as to bear its proportion of the shortage. This shortage will, according to present estimates, be corrected gradually beginning with the next calendar year, and will be wiped out in approximately two years.

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New England Net-Work of Air Lines Contemplated

THE establishment of a network of New England airways to connect Boston with the other business and industrial centers and also with the summer resorts is a project now being undertaken by the Boston Chamber of Commerce. Plans are under way for the formation of local aviation committees in the principal cities and towns of New England and for the building of landing fields in the various communities.

The Chamber has been assured of the cooperation of the Army Air Service, which is doing much in the establishment of national airways, and of the New England District of the National Aeronautic Association.

Now engaged in working out the plan is a committee of Chamber members, the chairman of which is Colonel Edgar S. Gorrell of the Marmon Boston Company. The other members of the committee are: Porter H. Adams, engineer; George Bramwell Baker, of Baker, Young & Company; W. Irving Bullard, vice-president of the Merchants National Bank; Emery Haseltine, of Kimball, Russell Company; and James T. Williams, Jr., editor of the *Boston Transcript.*

The recommendation of this committee that an active campaign be conducted for the establishment of a system of airways in New England has been approved by the Board of Directors of the Chamber, and the committee has been granted authority to make all arrangements. It has already obtained the names of persons who are interested in promoting the plan in their different communities.

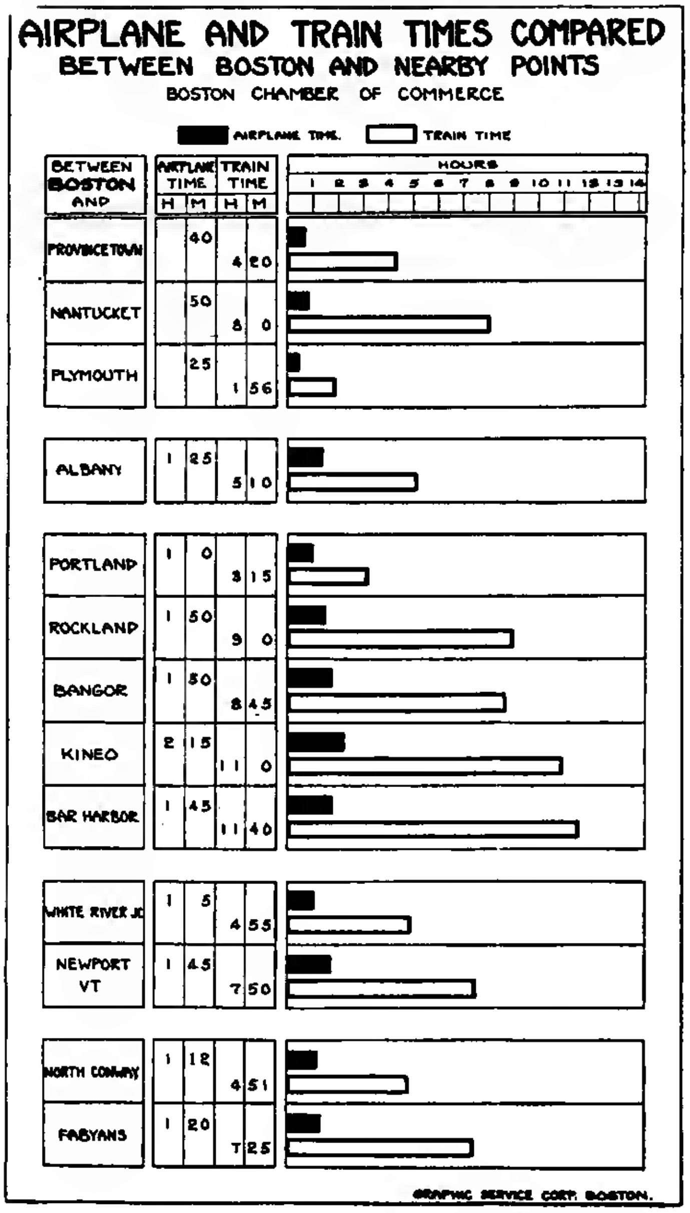
Boston has an airport already under construction. It is expected to be completed by July 1. It is located at Jeffries Point, East Boston. Several other sections of New England also have airports, namely, Hartford, Conn.; Burlington, Vt.; Brunswick, Maine; and Springfield, Vt. The Chamber will cooperate with those in charge of these airports.

"Airways, or aerial highways, are as essential to the development of aviation for commercial purposes as are airplanes and trained pilots," declares the Chamber's committee in a report it has just issued. "The public will not trust itself or its property to any means of transportation until it is assured that the 'roadbed' and terminals are as safe and adequate as the equipment and personnel.

"We already have, and are further developing, airplanes that are safe, economical and practical. Skilled pilots and ground personnel are also available, but with the one exception of the air mail route from New York to San Francisco, there are no adequate airways in the United States. Accordingly almost no use is being made of the wonderful opportunities of the airplane as a means of rapid commercial transport.

"An airway, when fully developed," continues the committee, "is a route between two points, well mapped, and with airdromes and emergency landing fields, so marked as to be readily recognizable from the air, at relatively frequent intervals. This interval should be such as will permit an airplane flying at a reasonable altitude along the airway to be at all times within gliding distance of a safe landing place in case it is forced down by engine trouble. It should average around fifteen or twenty miles. Of course, as night flying develops, it will be necessary along the airways used for such flying to provide beacons at the emergency fields that will operate for long periods without attention, and adequate lighting at the airdromes.

"In general, the uses to which airways will be put may be classified



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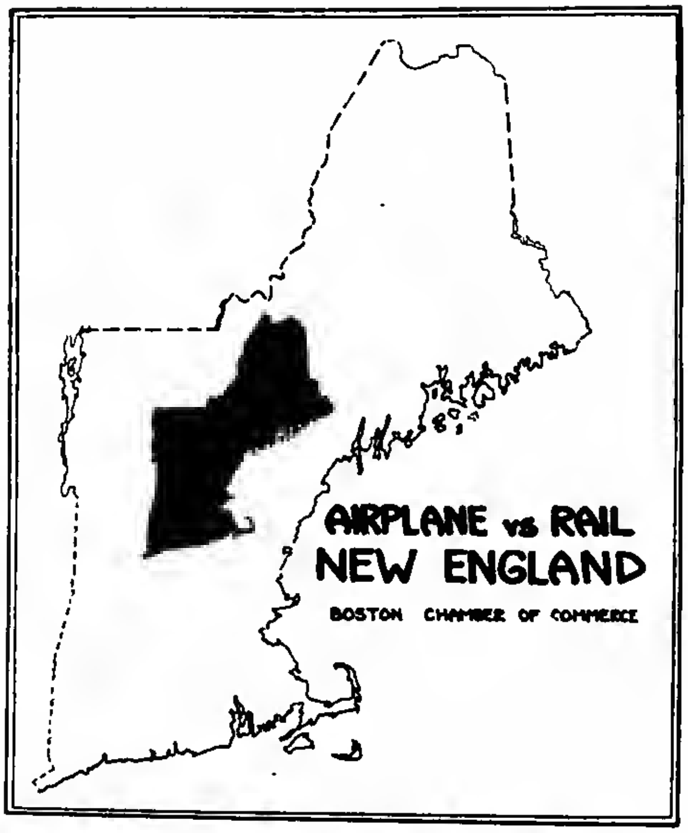
under three heads: (1) the strictly commercial, having as an object the saving in time in transport; and including the air mail; (2) the military; (3) other civilian flying, including that by individuals owning their own machines, and that by commercial operators taking people over territory where new or more beautiful scenery can be obtained from the air which cannot be obtained from the ground. Practically all airways will be used for the third type of flying.

"As a general thing, commercial aviation is not as likely to develop on a route where there is excellent limited train service, or an overnight train service as it is on routes where the distance precludes an overnight train service, or where the service is slow and connections poor. The military airways are such as will be of importance in connection with the defence of the country, and may or may not coincide with the commercial routes.

"A typical airway that should be of value commercially is that from Boston to Albany. At present, a man who desires to take the Twentieth Century Limited to Chicago must leave Boston at 12:30 p. m. in order to catch it at Albany. He spends five hours and ten minutes on the train, and covers 201 miles of track. If an airplane route were established, the distance would be cut to the actual air line distance—142 miles—and the time, because of the saving in distance and the increased speed, would be cut to approximately one hour and twenty-five minutes. The trip to Albany would be pleasanter, and it would not be necessary to leave Boston until practically the close of the business day.

"Similarly to Bangor. The train trip is nearly nine hours and not particularly pleasant. The airplane cuts the distance from 250 miles to 184 miles, and the time is only one hour and fifty minutes. Either of these routes should be of great value commercially.

"While the route between Boston and New York might seem at first glance to be the best proposition commercially, it is doubtful whether it will be of as great commercial importance at first, because of the excellent train service by night, and the limited trains. It is however, of vital importance in the aerial defence of the country. It is also essential if Boston is to have an extension of the air mail—unless a separate line from here to the west is established—and it is necessary if Boston is to be connected with Southern points by air.



Map Showing Relative Size in Hours of New England to a Traveler by Air and to a Traveler by Rail.

"Of use in the tourist business, which would come under the third classification, would be routes to New Hampshire, Vermont, and Maine summer resorts. These would not be of particular value commercially, in the sense that the route to Albany is of value, nor would they be essential to the military needs of New England. But because they would offer a new and pleasant means of travel, and would provide a view of the New England mountains and lakes that could not be obtained even by the sturdiest mountain climbers, such routes should prove of distinct interest to the visitor to these resorts.

"It is our opinion that the development of New England airways will tend to draw New England communities closer together and make of them a more compact unit. When it is possible for a business man to go from Boston to central Maine or northern Vermont in two hours, or to Providence in twenty minutes, or to western Massachusetts in a little over an hour, the tendency will be for him to take a greater interest in the development of New England as a whole."

The New All Metal Monoplane

The first all-metal airplane designed by the Engineering Division, Air Service, and manufactured by the Gallaudet Aircraft Corporation, was recently delivered to McCook Field and given its maiden flight. The model is a Corps Observation, its official designation being "CO-1".

Both the wings and fuselage are covered with corrugated duralumin, and the structure proper is heat-treated steel and duralumin. The weight of the airplane empty is 3,000 pounds; fully loaded it is 4,750 pounds. Unlike most metal-covered airplanes, the CO-1 is not over weight. It could safely carry loads greatly in excess of the specified design load, which is 1,750 pounds. It is powered by the standard Liberty 12 engine, and has a gasoline capacity of 125 gallons.

There are several unusual features embodied in the design. The primary function of this airplane being ground observation, the wing is placed at the top of the fuselage and its thickness reduced adjacent to the cockpit to give the pilot an unobstructed view of the ground. The wing tapers to its full thickness at a point four feet from the fuselage and is braced thereto by external steel struts. Glass windshields are provided at the sides of the pilot's cockpit, making the use of goggles unnecessary.

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Universal Propellers May Mean New Speed And Distance Records

IT MAY be of interest to speculate on what might again be done with the Army's Fokker if it becomes necessary to break the world speed records over again for 2500, 3000, 3500 and 4000 kilometers and the distance.

DISTANCE RECORD

It is assumed that the propeller used on the Fokker was of low pitch and that it turned at maximum rpm in getting off the ground with its great load of 739 gallons of fuel and 35 gallons of oil, using the 375 h. p. Liberty, with low compression pistons. As fuel is burned it is obvious that the rpm's would increase owing to the lessened head resistance due to the lightening load, making it necessary to throttle the engine to prevent its running above normal speed.

Distance is what we are after, say. This means running the plane at most efficient angles and the engine at most efficient consumption speed.

Now, using a Universal Propeller, the maximum load of fuel and oil could be taken off the ground, and climb to the desired altitude would be made quickly with the pitch at an efficient low angle, which would be a matter of predetermined knowledge and indicated on the dash.

Then the plane would be leveled out and with the consumption of fuel the pitch would be increased degree by degree, as shown on the dial, keeping the engine at its most efficient running speed. It is estimated that in the making of a distance record a Universal Propeller might be expected to furnish from 20 to 25 per cent. additional mileage.

The analogy might be something like this. We go out and make a distance and speed record with the flivver running in second speed. Now we go out and run the car over the same course in third speed and for the same engine rpm's we get a greater total mileage and a higher car speed throughout the trip.

However, the airplane with the Universal Propeller has a bit the advantage—it has an infinity of speeds, forward and reverse. But the reverse is the subject for another story.

RECORDS CARRYING USEFUL LOADS

The International Federation has now its new classification of records made carrying useful loads, in duration, distance, altitude. We can take out the Army Fokker, make some new world records, and then just as soon as the records are beaten, put on the universal prop—provided the enemy contestant doesn't do the same—and take the same old "ship" out and beat them all over again.

HIGH SPEED SHORT DISTANCES

Even in a straightaway, some additional speed is possible. Coming down in a dive, preparatory to straightening out for the course proper, with the universal propeller advantage can be taken of the power of the engine in addition to the power of gravity, to increase the speed. Instead of depending on the power of gravity alone as must be the case in using an ordinary propeller. This arises from the fact that the diving plane has a speed in excess of any possible pitch speed of the propeller unless turned at a speed above the highest speed at which the engine is capable of giving power.

SPEED RECORDS

A prop can be designed for only one thing at a time—high speed weight lifting, or lower engine speed for a given airplane speed. If a prop must be used which will take a great load off the ground it cerainly won't help any in making speed. If speed records are to be made over long distances at the same time, say, as a distance record is also being made, roughly half the journey at the start will be at comparatively slow flying speed and the prop must turn at high rpm to carry the load. The other half of the journey must be made with engine throttled so as not to race, thus reducing its power and cutting down the proper flying speed of the plane.

Here, the Universal Propeller permits the gradual increasing of pitch and airplane speed as the full load diminishes while the engine is running along at its proper rpm.

It may be conjectured that, perhaps, an increase in airplane speed could be made gradually up to 25 or even 30 per cent. above the initial speed at the last stage of a journey, of say, 4000 or 4500 kilometers.

Airplane Sky-Rocket Not So Good

Takes Five Times the Fuel for Same Flying Speed --Jet Propulsion Does Not Compete Yet With the Old Time Screw -- But There Are Possibilities

AT THE highest flying speeds yet attained, jet propulsion requires about five times as much fuel as ordinary screw propulsion. The relative fuel consumption and weight of machinery for the jet, however, decrease as the flying speed increases, but at 250 miles an hour the jet would still take about four times as much fuel per thrust horsepower-hour as the air screw, and the power plant would be heavier and much more complicated.

If Lee Burridge were alive today he would be much interested in these conclusions developed by the Bureau of Standards. The turning of an airplane into an animated rocket was a pet idea with Burridge.

Now, at the request of McCook Field, which is interested in jet propulsion and helicopters and other ideas aimed at the home designing of machines which can outdistance the world and generally at the putting of America "first in the air," the Bureau considered the plan of issuing from a nozzle a continuous stream of combustion products, making of the airplane, in fact, a pseudo winged rocket. The air needed for the jet was to be taken in by a power-driven compressor and delivered at increased pressure to a receiver acting as a combustion chamber. The liquid fuel was to be sprayed into the combustion chamber and burned there continuously at constant pressure, so as to increase the temperature and volume of the gaseous mixture. The resulting combustion products, consisting mainly of nitrogen, steam and carbon dioxide, were then to expand freely through a suitable nozzle from the receiver pressure to the outside atmospheric pressure at which the air was taken in by the compressor.

"For the present we shall consider only a simple nozzle such as used in steam turbines, and we shall not dis-

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cuss in detail the possibility of improving the propulsive efficiency of the jet by any of the 'aspirator' or 'ejector' devices which have been proposed for increasing the momentum and thrust. If such devices are found to be effective, the prospect for jet propulsion will be correspondingly improved; but we wish first to inquire what might be done without them and from what point improvements must start."

The power needed to compress the air for the jet was found to be greater than that required for the same thrust power from an air screw of 70 per cent. efficiency, until the flying speed is about 250 m. p. h.

However it is considered the engine might be run faster than is now customary and thus reduce the weight per b. h. p. over that of the air-screw engine. But the air cylinders would add weight again and it is estimated that, at best, the combined engine-compressor unit would be at least 50 per cent. heavier than an ordinary aeronautic engine of the same power. This observation does not include the weight of combustion chamber, nozzle and fuel injection system, which, it is estimated, would more than offset the weight of the screw propeller.

The "large, awkward and fragile" propeller would be eliminated, "and only the nozzle and not the engine would have to be located with regard to the axis of thrust. Thus the design would be more flexible. The machine might....be given brilliant maneuvering powers by utilizing the powerful steering effect of swinging the nozzle."

Yet, there still seems to be another drawback. "A machine which had to start—if it could get off the ground at all—by emitting a jet of flame at 2500 degrees F. and at a speed of one mile a second would hardly be a welcome visitor at flying fields."

Last, but not least, Mr. Edgar Buckingham, of the Bureau of Standards, author of the report which is being published by the N. A. C. A., says there does not appear to be, at present, any prospect whatever that jet propulsion of the sort here considered will ever be of practical value, even for military purposes.

Millions Involved in Two Grant Patent Suits

RUDOLPH R. GRANT comes into court through Vernon M. Dorsey, Trustee, who alleges that the Army and Navy have used one of his patents without right of license, although notified of infringement, and he asks that Uncle Sam pay him the sum of $200 for each and every airplane made for him since July 1, 1918, which is alleged to have infringed his patent.

This patent is No. 1,263,757, granted April 23, 1918, on which application was filed February 6, 1912. The principle claim of interest at the moment is that covering the wing curve employing the Cissoid of Diocles. It is claimed by the Grant interests that in the DH4s was used the RAF-15 wing which is said to use the cissoid of Diocles. Some 3227 of these had been completed up to Armistice Day alone.

Grant was the inventor of an "aerostable" machine with which a novice, M. H. Simmons, began flying in 1911, never having been in an airplane before. In this machine was incorporated the cissoid of Diocles wing curve, it is said, and other principles of inherent stabiliy resulting from experiments begun two years before.

The claims sued upon in the curve patent are abstracted as follows:

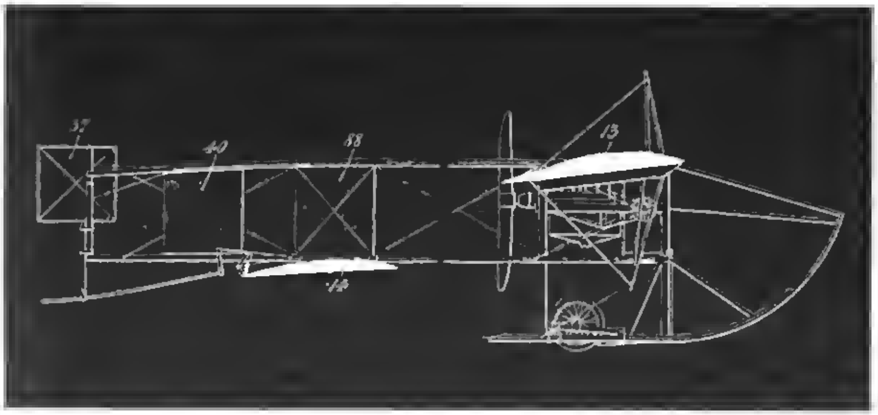
A supporting surface for a flying machine having a fore and aft curvature, the curvature being a cissoid of Diocles, the vertex of which forms the entering edge; a member adapted to react with an aero-form fluid having its curvature that of the cissoid, etc.

The claims in all number 17.

SECOND SUIT

In the second suit, brought by R. R. Grant himself, as plaintiff, the claims are on the grounds of longitudinal stability. Grant admits to being the discoverer of the laws of longitudinal stability. He claims $200 for each airplane, of every kind and description, made by or for the Government since July 1, 1918. The number will be that representing the major portion of those made during the war, totalling, it has been alleged, in the neighborhood of 15,000. From records, during 1918 and 1919 some 12,325 airplanes were built for the Army and 2966 for the Navy, not to mention those delivered thereafter on uncompleted contracts. Here is a tidy little nest egg of $3,000,000 or more, it would seem.

The Grant suit may not immediately appear of so great interest. He makes no charges of conspiracy nor of attempts against his life, liberty and pursuit of happiness, if such is possible in aeronautics. He was not involved in any contracts during the war, nor since, so far as one has been able to discover without research, and has generally kept himself rather quietly in the background.



Side view of the Grant Machine

However, his knowledge and experience in the field of aviation was not lost to the country in the late war, as we find him one of the first to offer his services in this particular field. He served as an Assistant Engineer in the Inspection and Production Departments from April 1917 until May 1919, at which latter date he returned to commercial life. His work for the Government during the war period was largely reproduction work, he not being assigned to any work involving the questions of design.

Grant states in this case, also, that

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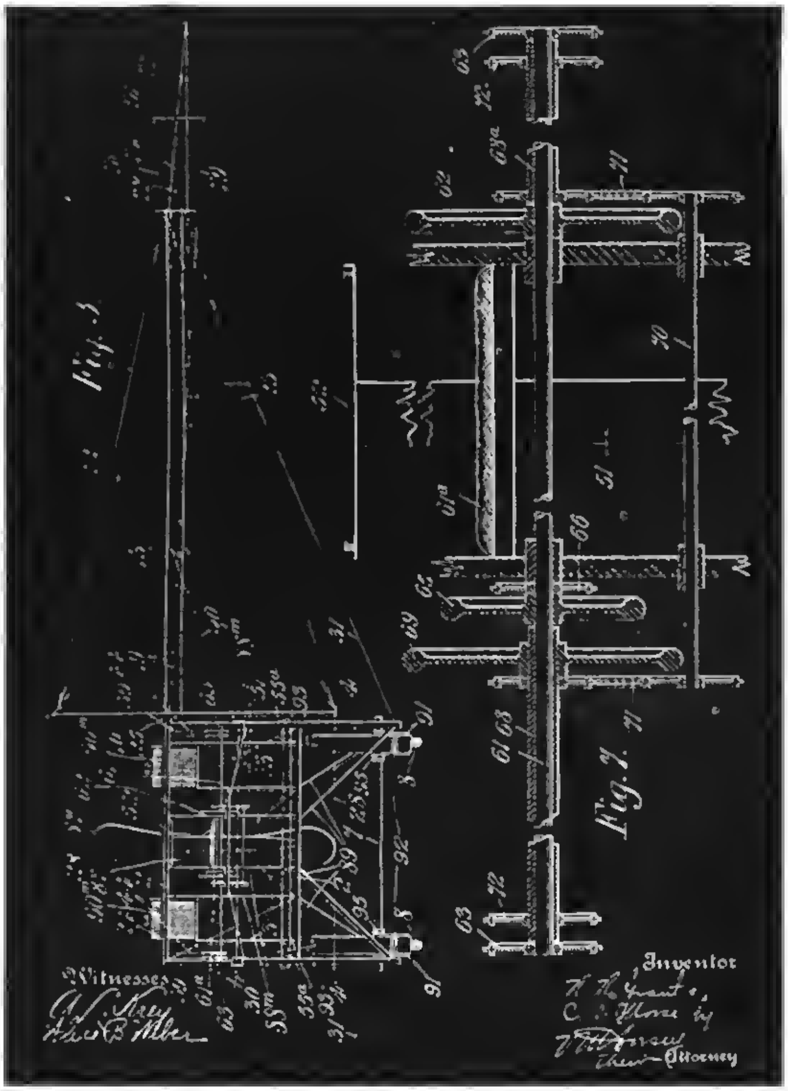

Details of the Grant system of control

the Army and Navy made use of his invention and discovery without right or license, although notified of infringement of his patent 1,195,207, granted Aug. 22, 1916, on which application was filed Oct. 27, 1913.

The claims on which reliance is being placed may be abstracted as follows:

An airplane in which at speed of normal horizontal flight the center of gravity is in front of the center of lifting effort and is in the rear thereof at excessive speeds above the same; an airplane in which the c. g. and c. of drift pressure are maintained coincident under varying conditions of flight, and a propeller located substantially at such co-incident point.

In all there are 9 claims respecting the same principle of design.

The object of the Grant invention in longitudinal stability is to provide an airplane having the centers and the direction of the application, of its forces, reaction and masses so positioned with respect to each other as to insure inherent stability. For this purpose the machine, which was built and flown in 1911 and 1912 both as a land and as a water machine, was so designed that its center of gravity and its center of drift pressure, or head resistance, as well as the center of application of the propulsive power, were practically coincident. At normal speed of horizontal flight the c. g. is slightly in advance of the center of lift. With the increase of speed the center of lift will shift forward. The center of lift and the center of gravity are both designed to be located in the line of thrust.

By this construction upon turning the machine upon its c. g. without substantially displacing the center of the propeller, and with only an angular change in the position thereof, the propeller does not by its thrust resist or aid such change or swing of the machine, the only action of the propeller being that of a gyroscope tending to prevent change in the angular position of the axis of the machine.

By this location of the center of pressure with respect to the c. g. at normal speed of horizontal flight, the elevators are normally called upon to slightly lift the head of the machine. A slowing down of the machine effects such change in the location of the c. p. with respect to the c. g. that the machine drops slightly by the head and starts to glide, with its attendant increase of drift speed, whereupon the c. p. again moves forward and tends to head the machine up, this being repeated in case of engine stoppage and as often as may be necessary to effect a safe landing by a series of glides or recoveries.

Variation was also possible in the angle of incidence by the aviator and an arrangement was provided whereby the relative position of the fore and aft supporting surfaces could be varied coincident with the change in the angle of incidence in order to maintain the center of lifting effort constant with respect to the c. g.

The Grant system is especially applicable to monoplanes and to machines in which the desired vertical position of the center of pressure is obtained by placing the rear plane behind and below the forward surfaces.

The design of the machine is, further, such that the c. of p. remains substantially in the line of thrust and does not vary vertically with respect to the c. g., in spite of its forward and back movement with respect thereto at different speeds.

In Fig. 1. is shown a sketch of the Grant machine as built and flown by a novice.

On each side of the fuselage are forward pivoted wings 13 and underneath at the rear, another pivoted supporting surface 14 the latter being below the front surface and having its center of pressure below the line of thrust, and being at a less angle of incidence than the front planes, while the front planes have their center of pressure above and on the upper side of the line of thrust. The propeller is mounted in the line of thrust, the center of the propeller being substantially at or slightly in the rear of the center of gravity, the center of the propeller being as close thereto as the limitation will admit. Elevator 37, rudder 40 and vertical stabilizer 88 are provided.

The front planes 13 are pivoted along the forward main spar to the fuselage and are movable on such pivots to change their angle of inci-

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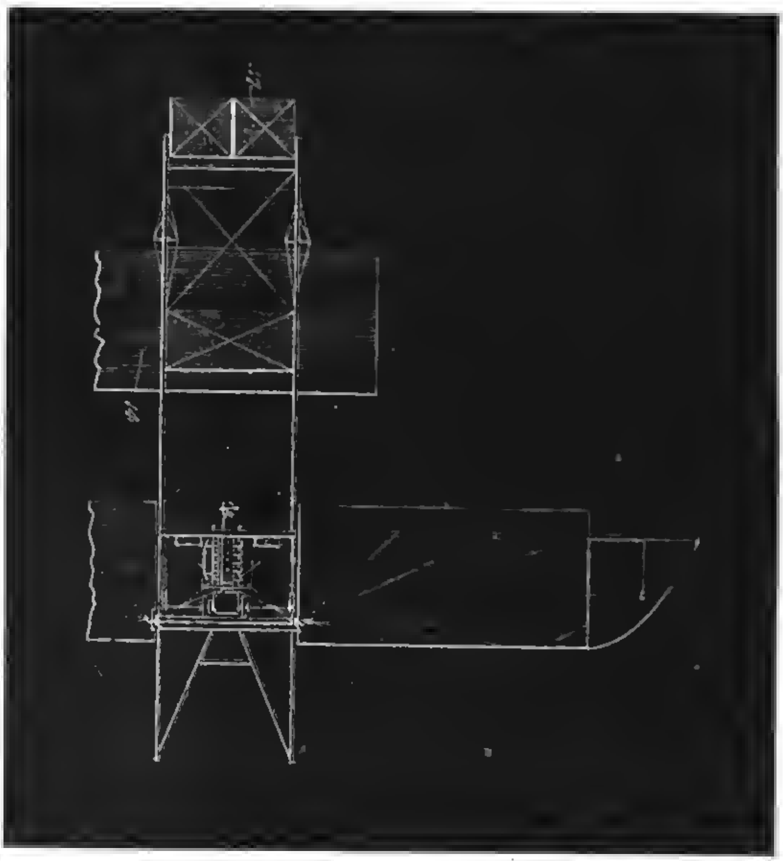
dence. The mechanism for this purpose comprises travelers sliding longitudinally in the fuselage of the machine, there being one traveler on each side of the machine connected to the corresponding front surface. The rear plane 14 is also pivoted to the fuselage and is moved upon such pivot by means of connecting wires, one wire being connected to each traveler and to the corresponding side of the rear plane, the inclination of the rear plane being less than that of the front plane. The curvature of the front and rear planes is that of the cissoid of Diocles. In such a construction, the machine can be slowed down by increasing the angle of incidence of the several planes, but due to the character of the curve of the planes this is accompanied by a rearward shifting of the center of lifting effort on each of the planes, and therefore, unless means be provided to prevent it, by a rearward shifting of the combined center of lifting effort in respect to the center of gravity and a consequent disturbance of the balancing conditions of the machine. To prevent this the invention contemplates a bodily movement of the rear plane upon the fuselage upon a change of angle of incidence, whereby it will be moved forwardly upon an increase of the angle of incidence of the several planes and will be moved rearwardly upon a decrease of the angle of incidence of such planes, and whereby the conjoint center of pressure of the several planes under varying conditions of angles of incidence will be maintained substantially constant in respect to the center of gravity. To effect this longitudinal movement of the rear plane upon a change of angle of incidence the rear plane is pivoted in blocks sliding on bars depending from the lower members of the fuselage. The rear end of the rear supporting plane is adapted to be angularly adjusted by means of links pivoted to the fuselage and to the plane and having connected thereto, intermediate of their ends, connecting wires, one end of which wires may he led through a slide bar, the other end of such wires being passed over pulleys to the rear of the supporting plane and returned through leaders and passed over pulleys in front of the travelers to which the other end of the wire is connected. The link contains a series of perforations whereby the desired angle of incidence may be obtained according to the several conditions which may arise.



Plan view of the Grant machine

The Story of an Endurance Test of a Remarkably Reliable Engine

DURING the past year Lieutenant B. G. Leighton, of the Bureau of Aeronautics, Navy Department, has been working steadily to bring about improvements in engines, in order to provide greater durability and reliability. During the war, duration tests were conducted over periods of fifty hours of running. It was a mark of distinction to pass such a test successfully, although the engines were not run at full throttle, the run was broken into five separate periods of ten hours each, and all ordinary adjustments and replacements of minor parts were permitted. Improvements made to post-war types convinced Lieutenant Leighton that a longer period of test than fifty hours was required to measure the life of new engine types. Accordingly, specifications were drawn for an endurance test of 300 hours, although the engines were only required to develop about six-tenths of their rated horse power. As certain types of engines successfully met this test, new specifications were arranged, requiring engines to operate at full rated horse power and to use standard aviation gasoline.

Some time ago, a Wright E-2 engine was submitted to this latter test. The test was conducted at Anacostia, under the direct supervision of the Bureau of Aeronautics. It was found that the E-2 performed very well up to 125 hours, but at the conclusion of that period of running, the valves, and valve seats particularly, and the pistons were in bad condition, requiring replacement before continuing the test. In connection with the life of the E-2 engine at full throttle, it is interesting to note a statement recently given out by Lieutenant Leighton in a pa-

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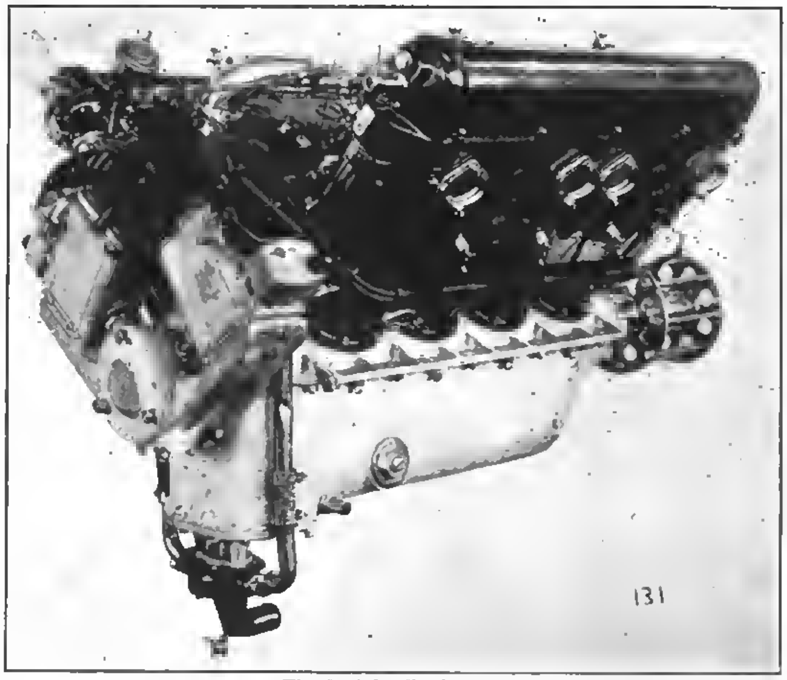
per read before the Washington Section of the Society of Automotive Engineers. The fact is brought out in this paper that the Liberty engine, which is a war development, and by many still considered to be the standard of durability, has an average life of 72 hours between overhauls in actual Navy service, while the Wright E-2 engine has an average life in actual service of 101 hours between overhauls, and under substantially the same service conditions. It is, therefore, apparent that, while the E-2 was not capable of successfully meeting Lieutenant Leighton's full throttle endurance test, it, nevertheless, showed remarkable improvement over war time standards of reliability.

Meanwhile, the Wright Aeronautical Corporation was developing a new type of cylinder design. This design was first worked out on their twelve cylinder 600 h. p. type, known as "T-2", and incorporated in that type. With Lieutenant Leighton's permission, it was determined to construct a pair of cylinder blocks of this new type, and again make an effort to meet successfully the Navy's full throttle endurance test. This type engine, which is in current production, is known as type E-4 and is the very latest Wright development in the 200 h. p. size. In order to measure the length of life of certain of the major parts of the engine, the new type of E-4 cylinder blocks were mounted upon the same engine which had previously run 250 hours of full throttle on the E-2 test. No changes were made in the engine, except the replacement of the E-2 cylinder blocks with the E-4 type. This E-4 engine has just completed a successful 300-hour full throttle test. Certain press dispatches in connection with the completion of this test erroneously stated that the E-4 engine had been operated continuously for a period in excess of 500 hours. As a matter of fact, not even the last 300 hours of running were continuous. No involuntary stops were made during this latter period, but several voluntary stops were made, principally to change clubs, as the engine was operated on a torque stand with the clubs exposed to the weather. Moreover, the early part of this test incorporated certain tests of lubricating oils, and one or two stops were made for the purpose of changing oils. However, the engine did operate throughout the 300-hour period without failure of any part, either major or minor, and the valves and pistons were in almost perfect condition at the conclusion. In fact, the engine was pulling a trifle more horse power at the conclusion than at the beginning of the test. Throughout the run it averaged approximately 205 h. p.



The Wright Engine

Disassembly of the engine, and inspection disclosed the fact that a ball bearing retainer ring had broken away, and, very probably due to this, one of the crankcase studs was broken. Neither of these damaged parts, however, interfered with the running of the engine or with its ability to develop its maximum power at the finish.

In the past the limiting features of long durability at full throttle have been, primarily, valves, pistons and connecting rod bearings. In the E-4 type of cylinder construction, it seems that the Wright Company have set up an entirely new standard for these parts. The Wright engineers believe that much of this success is due to the new silchrome tulip valves and the new type of bronze valve seats, and in the case of bearings to the use of Kelmet.

Of utmost interest to service possibilities of the E-4 engine is its comparison to its predecessor, the E-2. Under full throttle endurance test, the life of the E-2 was apparently 125 hours, as against 300 hours or more for the E-4 under the same conditions. It is a fact that in actual service the E-2 may be operated for at least 100 hours between overhauls, which, of course, indicates a much better service life for the E-4. The superiority of these improvements for the training plane engine or for commercial projects, as compared with other types, is obvious, as it seems reasonable to believe that the life of the basic parts of the E-4 is likely to be more than that of the plane in which it is mounted.

Wright engineers believe that the results of this test indicate very conclusively that the operating life of the E-4 engine, between overhauls, may be expected to be at least six times the life which in the past has been realized with service types of engines.

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Cotton Transported by Airplane

FOR the first time in history cotton has been transported through air from the fields where it is grown to the mills where it is made into cloth.

This interesting event was recently made possible through the co-operation of the Army Air Service, the Board of Commerce of Augusta, Ga., the Wamsutta Mills of New Bedford and the Aeronautical Chamber of Commerce of America. Two giant Martin Bombing Airplanes left Augusta at 4:45 A. M. June 4th with two bales of cotton consigned to the Wamsutta Mills at New Bedford. They arrived at New Bedford at 4:39 P. M. actual flying time for 1000 miles being ten hours and fifteen minutes.

© U. S. Army Air Service.

Photo taken just after the landing of a Martin Bomber at Bolling Field, A. C. Left to right: Lieut. T. J. Koenig, A. S.; Mr. H. Carl French of the Wamsutta Mills, Shriner Bratton, Lieut. Wm. H. Bleakley, pilot of plane; Lieut. H. H. George; General Wm. Mitchell, General Mason M. Patrick, Shriner Goodwin; Lieut. C. H. Graybeal.

Immediately the raw cotton was rushed to the Wamsutta Mills where it was prepared for weaving on the looms. Next morning the two planes took off from New Bedford at 5:45 A. M. arriving in Wash. at noon.

The occasion for this really historic flight was brought about by the Shrine Convention in Washington. The flyers carried as souvenirs Masonic aprons made by the Wamsutta Mills from Georgia cotton, delivering them in record time.

While waiting at New Bedford, the flyers were entertained at a dinner presided over by Oliver Prescott, President of the Wamsutta Mills. Among those present were: Captain Romeyn B. Hough, 1st Lieut. Harold L. George, 1st Lieut. William B. Bleakley, 2nd Lieut. Carlyle W. Graybeal, Staff Sergt. Linwood P. Hudson, Staff Sergt. Peter Ceccato, Grover C. Loening, First President Aeronautical Chamber of Commerce, Hon. W. H. B. Remington, Mayor of New Bedford, Representative Charles L. Gifford, Lieut. C. B. Anderson, Commander Fort Rodman, H. C. Meserve, Secretary National Association Cotton Manufacturers, A. H. Andrews, Secretary New Bedford Board of Commerce, Ridley Watts, Ridley Watts & Co., Ernest V. Alley, Barrows & Richardson, Oliver Prescott, President Wamsutta Mills, W. R. West, Director Wamsutta Mills, O. S. Cook, Director Wamsutta Mills, C. F. Broughton, Treasurer Wamsutta Mills, G. E. Rycroft, Assistant Treasurer Wamsutta Mills, A. L. Emery, Agent Wamsutta Mills, W. F. Staples, Wamsutta Mills, H. C. French, Purchasing Agent Wamsutta Mills.

© U. S. Army Air Service.

Loading the cotton on board a Martin Bomber at Augusta, Ga.

Several addresses were made by men prominent in aviation and the cotton industry. Grover C. Loening, First President of the Aeronautical Chamber of Commerce, under whose auspices the flight was sponsored, made a plea for a Congressional regulation of flying in order that the air may be cleared of unlicensed and freak airmen so that development may be carried on by sane experimentation.

Charles F. Broughton, treasurer of the Wamsutta Mills, said: "I believe that the day will come when by air or some other means rapid shipment of cotton will be possible. Rapid shipment will mean added production which of course will mean lower costs. I think that the flight of to-day, which was completed within 17 minutes of the scheduled time, is an indication of

(Continued on page 346)

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New N. A. C. A. Air Speed Meter

A NEW type of recording air speed meter has been designed by the technical staff of the National Advisory Committee for Aeronautics for the purpose of recording the air speed in flight and for studying the flow in wind tunnels. By changing the diaphragm it is possihle to use it for studying a large number of aeronautic and automotive problems. For example, it could be used to study the pulsations of flow in an intake or exhaust manifold or the character of sound emitted by varions types of mufflers or the sound waves from a rotating air screw. For the latter uses this instrnment has the advantage over a number of laboratory instruments designed for recording sound waves, in that it is portable and can be used under conditions of considerable vibration without having its readings affected.

Air speed in flight has been recorded almost exclusively in France and in this country by the Toussaint-Lepère air speed meter which consists of a recording pen operated by a spring loaded bellows. For very accurate work this instrument has a considerable amount of friction and its natural frequency is so low that it can not be used to record rapid changes in air speed, such as bumps in flight or pulsations in the wind tunnel. The British have constructed a successful recording air speed meter in combination with their Mark II accelerometer which is of a higher frequency and has less friction than the Toussaint-Lepère instrument.

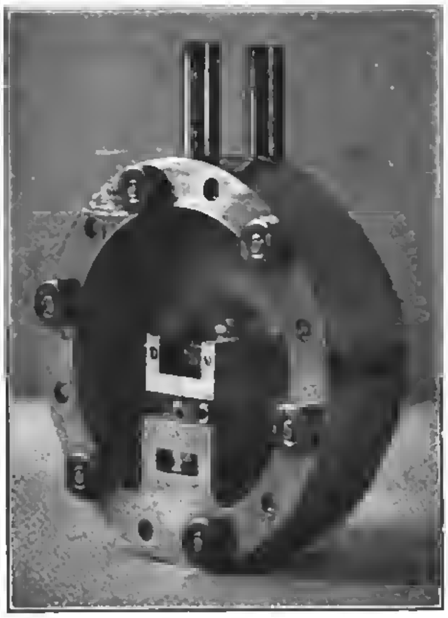

Fig. 1. Capsole and diaphragm

The N. A. C. A. instrument (Fig. 3) was designed with the idea of producing an instrument for recording the absolute air speed in flight with great accuracy and at the same time to have such a high natural frequency that it could be used to study the structure of rapidly changing air flow. As this instrument is of general usefulness in recording pressure difference it is thought that a complete description would be of interest.

*See *Acrial Age* for December, 1922, Page 585-586.

Diaphragm Capsule

The pressure difference to be measured is transmitted to either side of a steel diaphragm rigidly clamped at the edges between the halves of a circular capsule. As an unstretched diaphragm—due to a trace of concavity which can not be removed—has two points of equilibrium at zero pressure, it was found necessary to warm the diaphragm before clamping in order that it might be normally under a slight tension. It is also essential that the material of the capsule and the diaphragm have the same coefficient of expansion otherwise the sensitivity will change with the temperature. This capsule and diaphragm is shown in Figs. 1 and 2.

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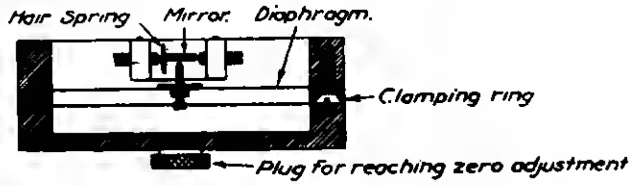

Fig 2. Section of capsule

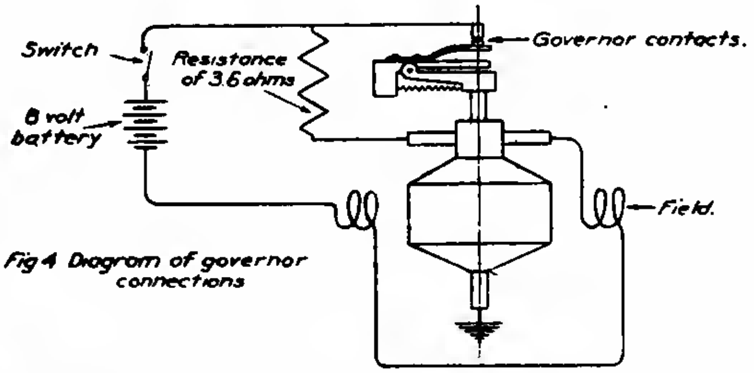

Fig 4 Diagram of governor connections

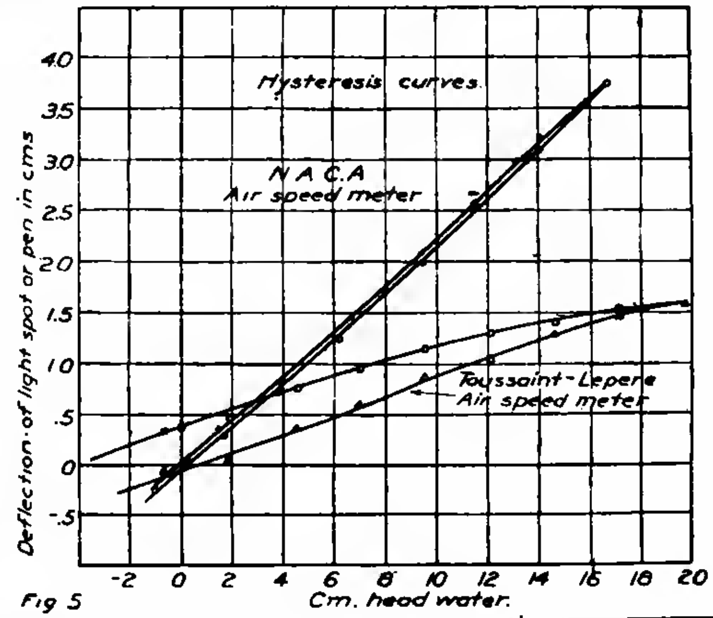

Fig 5

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A hardened steel screw passes through the center of the diaphragm and rests against the polished back of the mirror staff. This staff is mounted in a highly polished conical steel socket and is held against the diaphragm screw by a light hair spring. A plane silvered mirror 4 mm. square and .2 mm. in thickness is cemented to the staff. The deflections of the diaphragm are thus converted into a rotary motion of the mirror with very slight friction. The natural frequency of the diaphragm and mirror is about the same as that of a telephone diaphragm—2000 vibrations per second. This frequency could be made even higher than this if it were desired to use the instrument for studying high pitch sound waves.

THE FILM DRUM

The film is contained in interchangeable daylight loading drums revolving once in two minutes.

Fig. 3. Recording air speed meter

THE DRIVING MOTOR

The film is moved by an electric motor connected to the drum by a worm drive, and developed, after a considerable amount of experimental work, as the most satisfactory means of driving a drum at a relatively high speed. This motor is of the direct current, series type and is held at constant speed by means of a governor as shown in Fig. 4. This governor will hold the speed to within +2% of constant for considerable changes in voltage and load. The motor runs on 8 volts, normally taking 1.6 amperes and will reach its normal speed in less than one-half second after closing the switch, with a starting current of 4½ amperes.

PRECISION OF THE INSTRUMENT

The width of the line traced by this instrument is rather great, 0.010 of an inch, due to the poor quality of the lens. If readings are taken on one edge of the line the sharpness is sufficient to read within 1/1000 of an inch, which will give a precision of 1% when the deflection is only 1/10 of an inch.

In order to determine the hysteresis of this instrument its readings were compared with those of a water column when the pressure was increased and decreased. The difference between ascending and descending curves was nowhere greater than 2% of the maximum reading, and this would undoubtedly be greatly reduced under the condition of vibration which exists on the airplane. For the sake of comparison a similar run was made on a Toussaint-Lepère air speed meter with the pen resting on the paper in a normal manner. In this case the corresponding hysteresis error was 26% of its maximum reading. The two sets of curves are plotted in Fig. 5.

Several records are shown (Fig. 6) which were taken on a JN4H airplane in flight and it will be noted that even the high period bumps are recorded. In Fig. 7 are shown several records taken by speaking into the back of the capsule with the same diaphragm setting but with the drum revolving at a much higher speed. It will be seen that the sound waves are recorded very sharply even though the instrument was not especially lightened for this type of work.

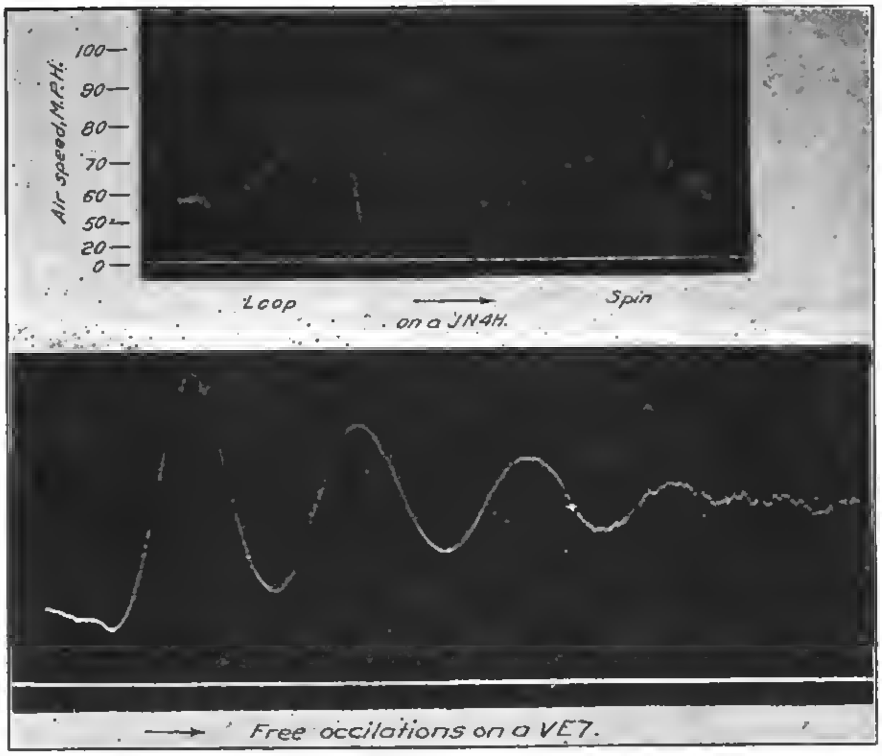

Fig. 6. Some records on full flight. One inch horizontally corresponds to 12 seconds.

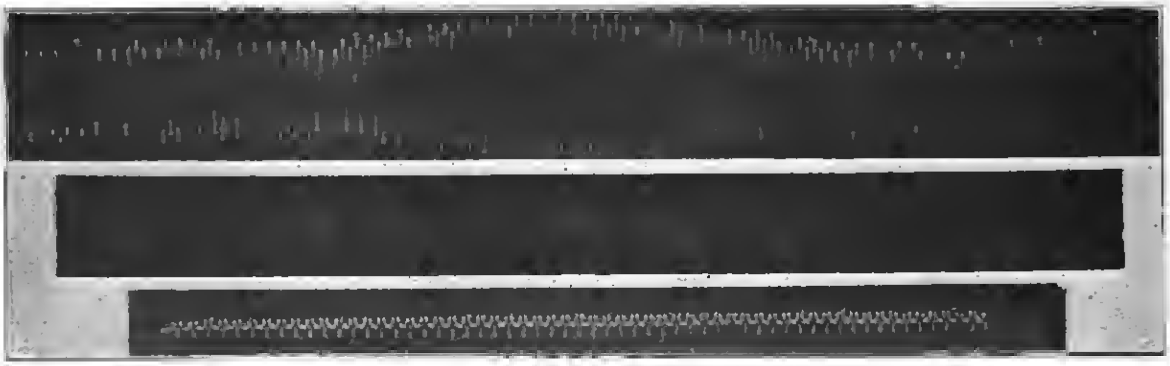

Fig.7. Sound waves produced by the human voice. One inch horizontally corresponds to .048 seconds

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Exponential Law of Variation of Drift and Lift of Models of Airplanes and Wings at Various Velocities

By Ing. Colonel G. Costanzi. and Captain Mario Bernasconi of the Italian Army

It is a well known fact that the resistance to the motion of a body in the air does not really vary with the square of the velocity. This was pointed out first by ourselves many years ago, (see Bulletin of Royal Establishment of Aeronautical Constructions, Rome, October 1912—Experiments on Hydrodynamics, by G. Costanzi), when we established the corresponding laws of variation.

The various peculiar aspects presented by the polar diagrams of models of wings and models of aircraft obtained at different wind speeds are also known.

The object of the present research work has been to find out:

(1) What are the laws of variation of drift and lift of models of airplanes and wings at various velocities.

(2) After these laws have been established, due to the fact that modern wind tunnels do not allow a wind speed anywhere near to the actual speed of aircraft in flight, are we justified in extending to actual flying conditions the laws which apply to wind tunnel experimental work?

(3) What is the difference between the polar diagram derived from the actual performance of an airplane in flight and the polar diagram derived from experiments made on a model in a wind tunnel?

Our investigation has been made on a number of models tested in the aerodynamic laboratory of the Experimental Aeronautic Institute of Rome. This work, however, can be continued in other laboratories and from the comparison of the results thus obtained the necessity of systematic experimental wind tunnel work in aerodynamic laboratories will be quite evident.

The results obtained so far on a number of models of wings and aircraft seem to be sufficiently interesting to be worth being brought to the attention of aerodynamic research workers. This work is going to be continued and completed. In the meantime, we will give a resumé of the work done and the results of experiments made on a model of triplane that we will call Co. Ma. (see figure 1.)

This model was very accurately made in aluminum, 1/50, size, so as to allow being successively tested in various aerodynamic laboratories. The upper wing of this model is the same as the R. B. 25, described in Technical Bulletin, No. 18, issued by the Italian Direction of Experimental Aviation. The central wing is the same as the R. A. 19, described in Technical Bulletin No. 2, and the lower wing is the same as Section E. F., of the wing R. B. 22, Fokker, described in Technical Bulletin No. 13.

The experiments were made at wind speeds of 15, 20, 25, 30, and 35, m/sec. Angles of incidence, between 0° and 20°, and between 0° and 12°. Negative angle is the angle of incidence with the model upside down. The 0° is referred to an imaginery line on the fusilage placed in a plane parallel to the three planes upon which the three wings would naturally rest, (bitangential planes to the lower ends of the wings).

In table No. 1, are given the results of the experiments made and in Fig. 2,3,4, and 5, are plotted the values of Rx and Ry. In these diagrams logarithms of velocities in meters per second were taken as abscissas and the logarithms of corresponding forces expressed in grammes were taken as ordinates.

The conclusions to be derived from these experiments are as follows:

(1) For each value of the angle of incidence the values of lift and drift, Ry and Rx, vary with the velocity according to an exponential law of variation. The exponent of this law however, is not constant and varies with the angle.

(2) While the exponent of the law of variation of Ry is in the order of magnitude of 2, the value of the exponent of the law of variation of Rx is in the order of magnitude of 1.74 for models of aircraft, and varies between 1.5 and 1.6, in the case of experiments made on models of wings.

In table No. 2, are given the values of the exponents of the exponential equations of Rx and Ry given in diagrams 2 to 5.

The values of n given in table 2 are obtained from experimental data. The values of n given in table 3, are obtained by interpolation from experimental data.

In fig. 6, the values of n are plotted against the corresponding values of the angles of incidence and from the resulting two curves shown in the diagram, we can derive the following conclusions:

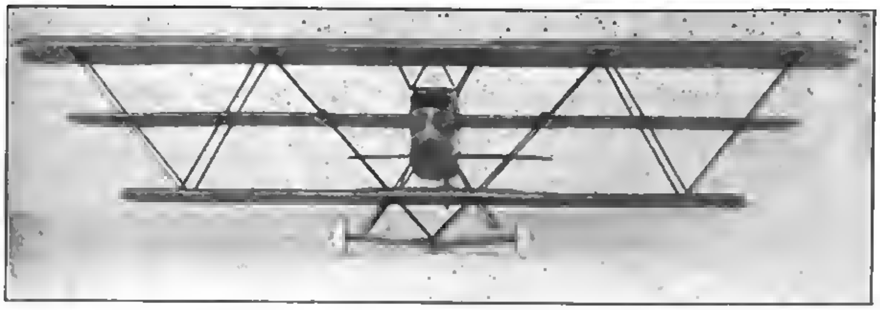
(1) *For any angle of incidence, the vertical component of the total air forces acting on the aircraft model tested, varies almost as the square of the velocity.*

(2) The values of n corresponding to the horizontal component is a minimum for small angles of incidence and increase with the angle, or more accurately stated:

The horizontal component of the total air forces acting on the aircraft model tested increases with the n power of the velocity. The values of n are nearly equal, 1.74 for angles of incidence varying between—5° and +2°, and for larger angles, both positive and negative, they rapidly approach 2. The horizontal component of the air forces acting on a wing model also varies as the n power of the velocity. For small angles the values of n are as small as 1.5, and in the average vary between 1.54 and 1.6. Also in this case, the tendency of n is to rapidly approach the value 2, in the region of either positive or negative angles.

(3) In the region of an angle of incidence of about 4°, (where in the case of the model tested the vertical component is equal to zero) the phenomenon which takes place is not quite well defined and more experiments are needed in order to clarify it.

(4) The foregoing conclusions have been confirmed by all experiments made on other models which we are



Model of Co. Ma. triplane, made of aluminum, span 0.82 meter

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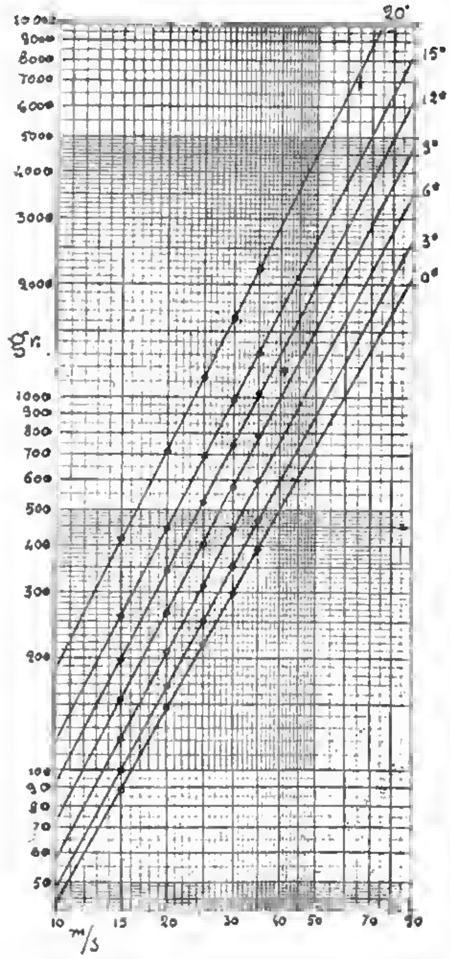

Fig. 2. Values of Rx; Co. Ma. triplane model (Positive angle of incidence)

not at liberty to divulge at the present time. Some slight differences have been noted in other experiments in relation to the minimum values of n and in relation to the limits of variations of n within the region of minimum values.

Considering the fact that the angle of incidence of an aircraft is more or less a theoretical conception, we can be satisfied if experiments on models confirm in a general way the exponential law of variation given in fig. 6. Also considering the fact that in fig. 2,3,4 and 5, the values of Rx and Ry for any corresponding value of the angle of incidence are plotted on straight lines, we feel authorized also in this case to extrapolate.

If we assume that a test has been made at a wind speed of 10 m./sec. (which is the ordinary wind speed used by a number of aerodynamic laboratories) and also a test had been made at 70 m/sec. (which is the actual speed of a number of aircraft), the values of Rx and Ry can be assumed to be those indicated in the diagrams shown in fig. 2 to 5, which are tabulated in table 4.

Let us assume now that an aircraft manufacturer has the values of Rx and Ry either at a velocity of 10 m./sec. or a velocity of 70 m./sec. and let us see what are the conclusions that he might arrive at when using for designing purpose either one or the other set of values.

Let us assume that the model used is the model given in fig. 1. Knowing the values of Rx and Ry at 10 m./sec. and at 70 m./sec. respectively and applying the laws of varion of Rx and Ry given in fig. 2,3,4 and 5, we can find the values of Rx and Ry at a velocity of 1 m./sec. in either case. Applying the law of variation based on a constant value of $n=2$ which is ordinarily assumed to be true, we have the values tabulated in table 5 and we can draw two polar diagrams (see fig. 7), one based on the known values of Rx and Ry at 10 m./sec. and the other based on the values of Rx and Ry at 70 m./sec.

We have thus two polars at 1m./sec., if we take a constant value of $n=2$, while we would have had only one polar if we had applied the law of variation of Rx and Ry that has been revealed by our experiments.

From a cursory examination of the two polars we can see that if either one or the other is used, the anticipated characteristics of the aircraft based on either of the two are quite different. If we assume a total weight of the aircraft of 6500 Kg. and 1200 useful horsepower available (or about 900 H.P. after deducing the losses in the propeller and the transmission) we have:

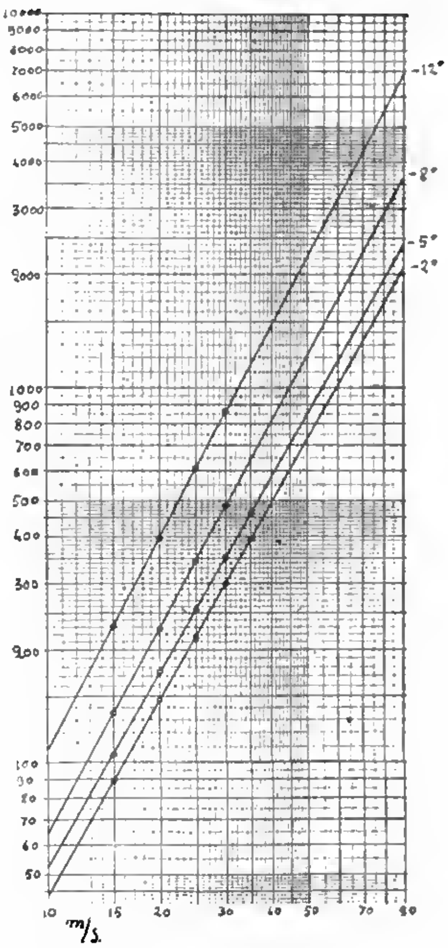

Fig. 3. Values of Rx Co. Ma. triplane model (Negative angle of incidence)

From a Polar Diagram Based on the Data obtained at 10m./sec.

Maximum velocity on the ground	143 Km/hour	
Minimum " " " "	78.5 "	With minimum H. P.
Velocity at 6000 m.	129.5 "	
Ceiling	6,950. Meters	
Velocity at the ceiling	115. Km./hour.	

From Polar Diagram based on Data obtained at 70 m./sec.

Maximum velocity on the ground	163. Km./hour.	
Minimum " " " "	84 "	With minimum H. P.
Velocity at 6000m.	158.5 "	
Ceiling	7,700 Meters	
Velocity at the ceiling	127.55 Km./hour.	

If the aircraft is equipped with a supercharger capable of maintaining constant power up to 6,000 m. altitude, assuming that the power absorbed is 12% of the useful power available, and applying the Eiffel method we have:

	From polar diagram based on data obtained at 10m./sec.	From polar diagram based on data obtained at 70m./sec.
Velocity at 6,000 m., Km./hour	166.	198.
Ceiling	9,900 meters.	10,800 meters.
Velocity at Ceiling Km./hour	137.	153.

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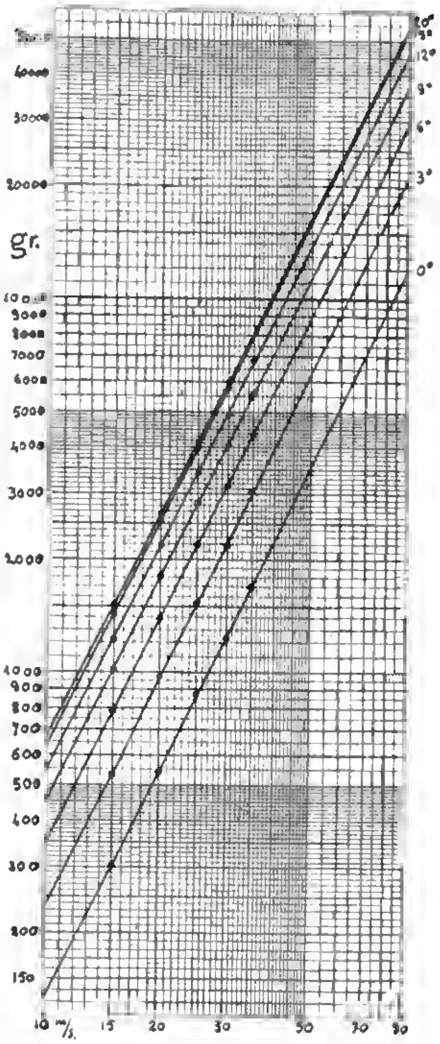

Fig. 5. Values of Ry Co. Ma. triplane model (Positive angle of incidence)

The discrepancy of the results obtained from the two polar diagrams is quite remarkable and emphasizes the necessity of taking in due consideration the data derived from velocities corresponding to the actual velocities of the aircraft in flight, keeping in mind in the choice of the velocity the principle of mechanical similarity also in relation to the density of the air.

Our experiments have pointed out a method of deriving a polar diagram for any velocity (if the extrapolation of our experimental results is correct) which is more nearly correct than the method heretofore used, which is based on a quadratic law of variation of Rx and Ry. The error involved in the use of our method is certainly smaller than if the other method is used.

It is evident, however, (and this we believe is a very important point), that in order to decide about the merits of a wing section on the basis of a wind tunnel test, the guiding consideration must be the value of the *n*

TABLE NO. 1

Angle	V = 15 m/sec.		V = 20 m/sec.		V = 25 m/sec.		V = 30 m/sec.		V = 35 m/sec.	
Io	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)	Rx (gr.)	Ry (gr.)
12°	231	606,7	397	1063,5	608	1685,5	863	2511,5		
8°	133,4	310,1	227,8	560,1	345,2	855,1	484	1266,3		
5°	104,3	79,1	174	131,6	253,8	218,4	352	303,3	416,3	427,4
2°	89,4	148,5	148,6	267,8	215	408,2	299	608,5	394,0	481,8
0°	88,8	301,3	147,1	542,3	217,8	873,1	298	1236,6	388,8	1634,1
3°	100,5	536	167,9	974,5	250,2	1539,3	352	2187,2	467,3	3044,0
6°	121,2	779,9	207,4	1392	310,5	2195,2	445	3160,8	597,0	4344,6
9°	155,1	1013,8	264	1803,8	402,0	2833,9	572,2	4065,4	784,0	5629,8
12°	197	1230,2	342,8	2183,5	524,0	3418,1	748	4937,4	1022,0	6847,8
15°	258,2	1423,5	444,4	2538,6	690,0	3998,8	980,4	5780,1		
20°	415,0	1510,3	718,2	2651,4	1125	4135,3	1629	5880,2		

All velocities are expressed in meters per second and all forces in grams.

TABLE NO. 2 (Values of exponent *n*)

Angle i°	12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx	1,88	1,83	1,74	1,75	1,75	1,805	1,87	1,89	1,915	1,93	1,985
Ry	2,03	2,01	2,03	1,97	2,04	2,04	2,01	2,00	2,00	2,00	1,99

TABLE NO. 3 (Values of exponent *n*)

Angle i°	7°	6°	3°	2°	1°	2°	4°
Rx	1,788	1,758	1,74	1,74	1,75	1,763	1,832
Ry	1,99	1,983	2,07	2,03	2,03	2,04	

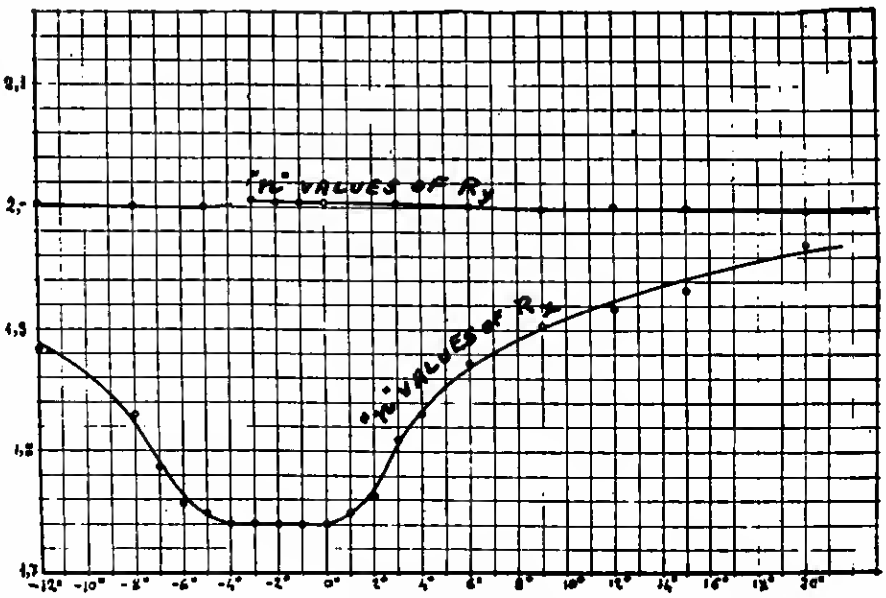

Fig. 6. Values of n for corresponding values of Roc and Ry at various angles of incidence

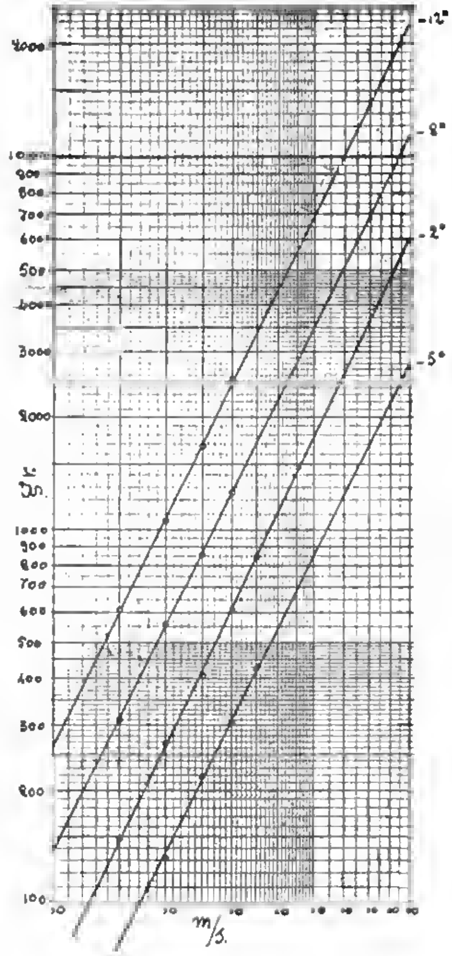

Fig. 6. Values of Ry Co. Ma. triplane model (Negative angles of incidence)

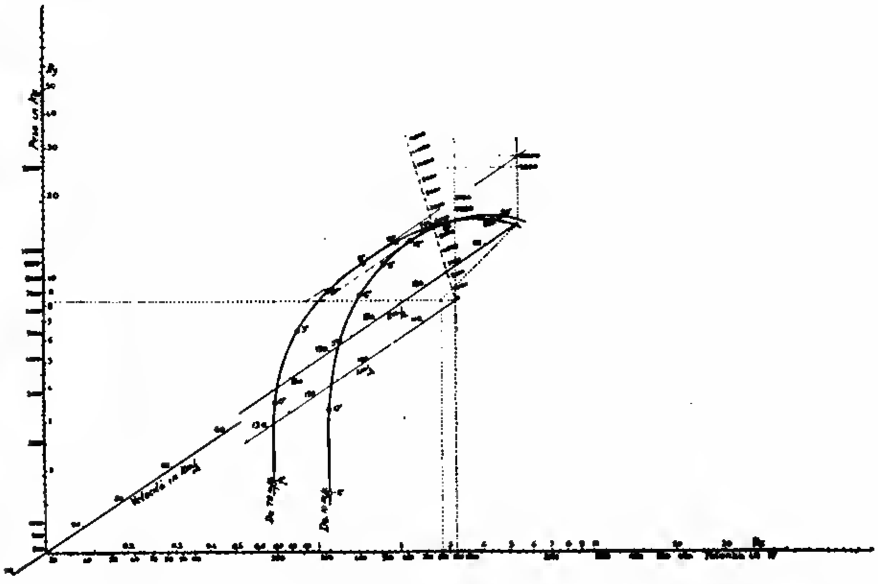

Fig. 7. Polars of Co. Ma. triplane based on experiments at 10 m sec and 70 m. sec respectively

power of the velocity according to which Rx varies rather than the *optimum* efficiency of the wing section tested at one particular air velocity.

It is possible that a wing section showing a low efficiency at the speed at which it is tested becomes a very efficient wing section at the velocity of flight, due to the variation of the exponential law according to which the air resistance varies at the two velocities.

In another article we will give a method for utilizing the results of our experiments for predicting the performance of aircraft in flight.

EDITOR'S NOTE:

The experiments made by Colonel Costanzi, a veteran in the field of aerodynamic research work, and by Captain Bernasconi point out once more the necessity of adopting a systematic and extensive program of comparative tests in the wind tunnels of all nations and over a large number of models.

Wind tunnel experimental work is done for the only purpose of helping aircraft manufacturers in designing better aircraft. If the cooperation of all aerodynamic laboratories is not secured, wind tunnel experimental work will be a matter of opinion and will never provide the scientific basis of aircraft design that aircraft manufacturers have a right to expect from this sort of research work.

Table No. 5

		12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx in	model scale 1 : 50 at 10 m/s	0,1085	0,065	0,052	0,0441	0,0439	0,048	0,057	0,07	0,088	0,119	0,185
Kg	Full size aircraft at 1 m/s	2,712	1,625	1,3	1.102	1,097	1,2	1,425	1,175	2,2	2,974	4,628
Ry in	model scale 1 : 50 at 10 m/s	0,264	0,138	0,0342	0,064	0,133	0,237	0,3488	0,452	0,550	0,639	0,675
Kg	Full size aircraft at 1 m/s	6,605	3,45	0,854	1,649	3,325	5,927	8,72	11,29	13,75	15,96	16,86
Rx in	model scale 1 : 50 at 70 m/s	4,325	2,3	1,56	1,335	1,330	1,65	2,16	2,895	3,8	5,13	8,60
Kg	Full size aircraft at 1 m/s	2,206	1,173	0,796	0,681	0,679	0,842	1,102	1,476	1,939	2,618	4,39
Ry in	model scale 1 : 50 at 70 m/s	13,75	6,95	1,695	3,52	7,15	12,55	17,75	22,2	26,8	30,5	32,1
Kg	Full size aircraft at 1 m/s	7,015	3,545	0,865	1,796	3,55	6,405	9,07	11,326	13,68	15,57	16,39

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Table No. 4

		12°	8°	5°	2°	0°	3°	6°	9°	12°	15°	20°
Rx	at 10 m/sec..........	108,5	65	52,0	44,1	43,9	48,0	57,0	70,0	88,0	119	185
	at 70 m/sec..........	4325	2300	1560	1335	1330	1650	2160	2895	3800	5130	8600
Kg	at 10 m/sec..........	264	138	342	64	133	237	348,8	452	550	639	675
	at 70 m/sec..........	13750	6950	1695	3520	7150	12550	17750	22200	26800	30500	32000

Proposed Activities of the National Aeronautic Association

THE following activities have been suggested to the National Aeronautic Association by William Knight which we endorse unreservedly.

AERIAL AGE has repeatedly supported the N. A. A. during the last eight months that this Association has been in existence. We feel however that the time has arrived when the N. A. A. shall begin to fulfill, at least in part, the program of activities outlined in its by-laws.—We feel that it is essential to create *services* to the membership and to initiate some sort of constructive action for making *"America first in the Air"* before the N. A. A. can honestly ask the support of a large membership.

We are confident that those who for the time being are in charge of the destinies of the N. A. A. will immediately act upon the suggestions made by W. Knight which, in our estimation, should be the foundation of the *Services* for which the N. A. A. has been created.

April 15, 1923

National Aeronautic Association of U. S. A.

The following activities are hereby suggested for the following Committees of which I have been appointed Vice-Chairman and of which I am at present the acting Chairman:

Foreign Relations Committee

It should be the functions of this committee to establish and to maintain a cordial exchange of information between scientists, technical and business men, aircraft manufacturers, aeronautical laboratories, aerial operating companies, aero clubs, aeronautical Chambers of Commerce, engineering societies and aeronautical organizations of any kind, both in this country and in Europe.

In order to make this work available to the membership at large and in order to be able to supply exact data and information on any particular subject, a list of publications and reports received from foreign countries should be published monthly in the aeronautic press, giving a brief outline of the information available.

Reports issued in a foreign language and new important articles appearing in the foreign aeronautical press should be either translated or abstracted into English according to their order of importance and should be published in the aeronautic press so as to make them available to the largest possible number of people.

The foreign relations committee should also provide for the N. A. A., being properly represented in any meeting and conference taking place in Europe where aeronautic matters of a general interest to all countries are discussed and should supply the N. A. A. representatives abroad attending these conferences and meetings with sufficient data about the aeronautic situation in the United States so as to enable them to properly represent us.

Also, the foreign relations committee should endeavor to facilitate the task of members of the Association going abroad in connection with aeronautic business or investigations in Europe, by supplying them with letters of introduction to people in Europe who can facilitate their work. A similar courtesy should be extended to foreigners coming to the U. S. A. on aeronautic business who are sent to us by our correspondents abroad.

In other words, the activities of this committee should be so directed as to make the N. A. A. the connecting link between aeronautic interests in the United States and in Europe and should be the authoritative source of information for the membership of the Association about everything concerning the aeronautic progress outside of the United States.

Industrial Relations Committee

The work of this committee should be particularly concerned with the liaison between aircraft manufacturers, aerial operating companies, engineering societies and the Government, in all matter in which the cooperation of these various organizations is concerned. This committee should keep a close track of production facilities available in the aircraft manufacturing industry in the United States and of up to date manufacturing methods and standardization, and should coordinate the work done at present by a number of organizations without much liaison.

It should also be the function of this committee to make a study of the matter of subsidies to be granted to aerial operating companies in connection with the transportation of mail and other services rendered to the Government and to make recommendations on this matter.

The subject of contracts to be awarded by the Government to aircraft manufacturers for the construction of military and naval aircraft and the best methods to be followed in this respect should also be the object of investigation by this committee.

The committee should endeavor to become the connecting link between aircraft manufacturers, aerial operating companies and the Government, and in every way, should encourage the development of commercial types of aircraft well suited to this kind of service required of them. This can be accomplished by promoting the establishment of suitable prizes for the right design of aircraft and power plant and by having the necessary amount of money invested in development work. Therefore, it should be the task of this Committee to find out what is needed in the matter, what can be done at the present time, to invite the cooperation of all concerned, and to follow up the work of cooperation between the various branches of the aeronautic industry and the government.

Scientific Research Committee

This committe should follow up the scientific research work being done in this country and abroad and should act as a clearing house of information and data for every individual and organization interested in the scientific end of aeronautic work, and should make available to the membership at large as much as possible of this work through articles published in the aeronautic press. This Committee will have to work in close connection with the Foreign Relations Committee for exchanging information and data with scientists in Europe.

Office of Aeronautical Intelligence

To carry out properly all of the work briefly outlined above, quite evidently shall require a sufficient clerical staff that we do not possess at present. There shall be a considerable amount of correspondence to be done and a good deal of translation work.

At the beginning I would suggest that we engage a translator possessing a good knowledge of foreign language so that we might be able to start the work.

One of the first things that we should do is to organize an office of aeronautical intelligence for keeping track of whatever is published both in the National and in the Foreign press on all subjects connected with the technical and the business aspect of aeronautics. Quite evidently, as we grow, requests for exact data and information on all phases of aeronautics will be sent to us from every section of the country and we must be prepared to answer them. This we cannot accomplish unless we organize this work before-hand.

WILLIAM KNIGHT
Vice-Chairman, Committees on
Foreign, Industrial Relations
and Scientific Research

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Howard E. Coffin, Pres. B. H. Mulvihill, V. Pres. B. F. Castle, Treas. John B. Coleman, Rec. Sec.

Official Bulletin of National Aeronautic Association of U.S.A.

Col. H. E. Hartney, General Manager Cable Address, Nataero
National Headquarters, 26 Jackson Place, Washington, D.C.

The National Aeronautic Association of U.S.A. assumes responsibility for the statements under this heading

BY courtesy of the Editor of Aerial Age, the National Aeronautic Association issues the following bulletin to its members:—

The following changes have taken place on the Board of Governors since the issuance of the June Bulletin:

Charles S. Reiman, governor of the 6th district has resigned on account of ill health. Mr. Reiman has been dangerously ill and has been obliged to give up all business and accordingly, the governors of the association regretfully accepted his resignation, which took effect June 15th.

To fill the vacancy on the Board of Governors in the Second District, Captain Theodore Knight has been elected governor. Captain Knight is one of the leaders in aeronautics in this district and the association is fortunate in securing the active aid and support of a man of such business acumen and prominence as Captain Knight.

Colonel H. E. Hartney, formerly acting general manager at national headquarters in Washington, is now vice president of the General Airways System, Inc., with offices in Washington. Colonel Hartney is no longer officially connected with the association.

On Tuesday evening, June 6th, the Philadelphia Chapter was formed following a dinner at the Bellevue Stratford Hotel. The charter was presented by Conway W. Cooke, chairman of the membership committee of the association, and the officers of the chapter were elected as follows:—Hollingshead Taylor, president; Samuel B. Eckert, vice president; and C. T. Ludington, secretary-treasurer. The following were elected to serve as directors: W. W. Kellert, president of the Aero Club of Pennsylvania; C. G. Ireland, R. G. Miller, R. P. Strine, H. N. Taylor, C. T. Ludington and S. B. Eckert.

The principal guests of the evening were Lieuts. Oakley G. Kelly and John A. Macready, who recently made the world's record for sustained flight, from New York to San Diego in 27 hours. Other guests were Admiral W. G. Harris, general manager of the Philadelphia Navy Yard; Vice President B. H. Mulvihill, N. A. A.; Edward Schildhauer, formerly chief electrical and mechanical engineer of the Panama Canal, and now chief electrical engineer of the American Investigation Corporation, a huge airship company; Commander C. G. Westervelt, manager of the Navy's Aircraft Factory at Philadelphia; Commander J. H. Klein Jr., executive officer of the Navy's Rigid Airship ZR-1; Commander H. W. Richardson, one of the pilots of the Navy's trans-Atlantic Flight; Lieut. C. A. Tinker, director of information of the N. A. A.; and Lieut. L. B. Mollison, aero officer of the Third Army Corps Area.

The principal speaker of the evening was Admiral Harris, followed by Lieuts. Kelly and Macready, who gave thrilling accounts of their trans-continental flight and the altitude flight of Lieut. Macready, who reached a height above sea level of 40,260 feet. Mr. Schildhauer, Capt. Cooke and Lieut. Tinker also spoke concerning the activities of the N. A. A.

Fifteen students of the Philadelphia Episcopal Academy who have formed the junior branch of the Philadelphia chapter, were present, and Alfred Ostheimer, 3rd., who headed the delegation, promises that the branch will be extended to include practically all of the students at the Academy, which will total nearly 300.

Moving pictures were shown of the trans-Atlantic flight and the Army's activities at McCook Field, which gave a very comprehensive idea of the methods employed by the Army Air Service in developing aircraft of reliability and usefulness in war and peace.

The following interview with Lieuts. Kelly and Macready was printed in the Philadelphia Ledger:—

Perhaps it is that eight months of overalls and grease with days and nights crowded with hope and doubt and a dozen other emotions battling for supremacy, can persuade a man that he is not a hero after he has achieved the almost impossible. Or perhaps it is merely the Army's system of effacing the individual and transforming him into a unit for the glorification of the service. The answer certainly is not to be found in the two men who did the almost inconceivable—a non-stop transcontinental air flight.

Lieutenants Kelly and Macready are not romanticists. They dream and hope for the best, but always in the iron-clad regulation army manner, and leave the weaving of romance to the public.

"It was a great flight, of course", said Lieut. Macready last night, "but when we landed on the coast after our trip, we certainly could not understand all the hurrahing of the people."

There is nothing in their appearance or manner to distinguish them from any other army aviators—just two happy, smiling, blue-eyed men who have found a strong anchorage in the army and aviation and probably would be at a loss what to do if they didn't have airplanes to fly and tinker with.

And the flight—Lieut. Kelly looked serious a moment as though peering into the past for something.

"That night watchman who said he saw us over Kansas City must have been dreaming", he said, "He was a darn poor watchman because we were not within 100 miles of that old town and we didn't want to be."

They realize now what they have accomplished—for aviation. But the long months of toil, of sleepless nights and worry, of test flights and endurance flights with the giant T-2 machine, is still the outstanding thought in their minds.

A successful flight consuming twenty-four hours cannot quite overcome those eight months of toil with grease-smeared faces and hands, and brains that ached for a rest.

And then, when the thing was accomplished the reality was bare, stripped of illusion and romance—just another flight.

"It wasn't until three days after it was over that we really knew what we had done", said Lieut. Macready. "We had dreamed of it so long and worked so hard that when it really came it was not so big after all."

"The public", said Lieut. Kelly, "thinks of this flight only as something never done before. They forget, if they knew about it at all, our hard work and study."

Lieut. Macready agreed with him on that score.

"It was a big week's work for me", he said, "I made that flight, won some money and topped it off by getting married".

Both men are fatalists as far as their careers are concerned. They like the army and intend to stay in it. And the future—well, Kelly is going to Mitchell Field, Long Island now.

"That flight doesn't mean anything to the army as far as Macready and I go", said Kelly. "We don't take our pick of places to go. We have to obey orders the same as any of the others. That's that!"

"And what were your sensations when you were flying?"

Lieut. Macready racked his mind for a suitable answer.

"What would they be after eight months of hard work and hoping? We hurried to New York, got the latest observations of the Weather Bureau, went out to Mitchell Field and made the final preparations. We were dog-tired and sleepy. Then we hopped off."

One could easily picture them crouched in the cockpit, peering into the gloom ahead, their eyes tense, the tiny wrinkles contracting as they sped through the air.

"There was no sleep for either of us. And we knew every place we passed," said Macready.

But the predominating thing in both men is their sincerity and love of flying and their fatalistic outlook for the future.

Two men who have achieved one of the greatest things in present day flying—Kelly wishing he could have stayed at San Diego and Macready still the hero of his own honeymoon.

Chapter activities are going on throughout the country in a very gratifying manner. Davenport, Iowa, has charter No. 3 and Akron, Ohio, has No. 4 for their local chapters, while applications for charters, up to June 14th, in addition to those already noted, have been received from Pittsburgh, Detroit, Miami, and Pensacola, Fla., Nashville, Tenn., Savannah, Ga., Waterloo, Iowa, Boston, Lowell, Springfield and Worcester, Mass., and Manchester, N. H., as well as many others, bringing the total number of cities and towns in which chapter activities are under way, up to 162.

NATIONAL AERONAUTIC ASSN.
By: C. A. Tinker,
Director of Information.

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THE NEWS of THE MONTH

Flight of ZR-3 from Germany to United States

The French magazine "L'Air", 15 April 1923, contains the following note stated to have been supplied by Mr. Benisovich, who, in September 1922, attended a conference at Baden-Baden where Dr. Eckener of the Zeppelin Company revealed certain details relative to the ZR-3. The conference had for its object to present to a group of representatives of Insurance Companies the risk which they were assuming; viz: the flight of the airship from Germany to the United States.

"Property Insured—Airship delivered by German Government to the United States on account of reparation in kind for the sum of 3,000-000 Gold Marks. The Zeppelin works are responsible for the risk of transport to the United States.

"Duration of Risk—The risk commences at the moment the airship leaves the hanger in Germany (Staaken near Berlin probably), to he completed upon landing in the United States (Lakehurst probably) at the moment when American personnel take charge. Risks of flight only are covered and not risks after landing or going out or going into the hangar.

"The experience of the Zeppelin Company which has constructed more than 100 airships, as well as the discipline of the German crew, present a substantial guarantee that no accident should take place in flight. The Airship will be subjected before her trans-Atlantic flight to an examination of experts and will carry out one or more test flights.

"Details of Construction—The Council of Ambassadors has designated the size of the airship at 70,000 cu.m. Based upon this figure the Zeppelin Company adopted as model the Bodensee, of which the length is 200 m. and diameter 28 m. approximately.

"The airship can carry 43 Tons of load; speed will be 130 km. given by five (5) engines of 400 H.P. each. The voyage of 7,000 km. could be made at a speed of 115 km. in 60 hours approximately, without taking into consideration contrary winds. A wind of 10 m. per second will prolong the voyage to 90 hours. Taking into consideration atmospheric conditions over the Atlantic Ocean and the modification of head winds by lateral currents, a time of 70 or 80 hours is counted on for the flight. A provision of 30 Tons of gasoline is sufficient for flight at 115 km. per hour for about 105 hours, giving a margin of 40 or 50%. By reducing the consumption of fuel 50%, the speed is reduced to 90 km.

"By making this demonstration the Zeppelin Company show their confidence and the successful completion of this voyage will permit them to offer their services to international capital for airship navigation over long distances without intermediate stops."

© Photo U. S. Army Air Service.

The "Leviathan" on its way from Newport News to Boston

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Naval Aircraft Factory Designers Win British Glider Prize

The twenty-five pound prize for the best design for a glider, which was offered by the British Magazine "Flight", has been divided between two designs which were tied for first place. One of the successful designs was submitted by R. G. Miller and D. T. Brown, Aeronautical Engineers, employed at the Naval Aircraft Factory, Philadelphia. The design of Messrs. Miller and Brown was of a semi-internally braced monoplane with plane area of 172 square feet, span of 32 feet and weight of 300 pounds loaded.

The Passing of a Pioneer Airman

The death of Major Thomas Scott Baldwin at Buffalo, N. Y., marked the passing of one of the earliest pioneers in the world of aeronautics. He was the originator of the parachute and had the distinction of being the first man in the United States to descend from a balloon in a parachute, a feat which he performed at San Francisco, Calif., on January 30, 1885.

Major Baldwin was born in Berrien County, Mo., January 30, 1854, and his flying activities extended from 1875 to 1921. There is probably no individual in the world today possessing the knowledge and experience which Major Baldwin had in connection with the building and flying of lighter-than-air craft. His experience included both the manufacture and flying of spherical balloons, hot air and gas, and dirigible balloons. In 1893 he operated at the World's Fair in Chicago the first balloon owned by the United States Signal Corps.

He was a manufacturer of airplanes for five years until enjoined by the Wright Brothers; was an aviator for five years, and held three international licenses for spherical balloons, dirigible balloons and as an aviator. His experiences included exhibition work in operating balloons in all parts of the world.

For two years he served as General Manager of the Curtiss Airplane Co., and prior to the outbreak of the war he conducted the Curtiss Aviation School at Newport News, Va., which he organized.

In August, 1917, he was ordered to active duty as Captain in the Army Air Service and assigned as Chief of Army Balloon Inspection, with headquarters at Akron, Ohio, where he personally supervised the construction and inspection of the entire balloon program of the Army. Upon his discharge from the military service he was appointed District Manager of Balloon Production and Inspection at Akron, Ohio, having complete supervision of the inspection and production of the lighter-than-air equipment of the Army Air Service.

One of his prized mementos was a four-karat diamond ring presented him by the King of England in recognition of his flying feats in that country.

Major Baldwin was a member of the Aero Club of America, Elks, No. 1 of New York, Odd Fellows, K. of P., and a 32nd degree Mason.

All Metal Commercial Plane Tested

The "Air Sedan", a Stout all-metal monoplane built for commercial purposes, is being tested out at Selfridge Field, Mt. Clemens, Mich., and is attracting considerable attention in and about Detroit. It is a three-passenger craft equipped with a Curtiss OX5 motor, and is showing up very satisfactorily.

No Change in Nationality Mark of American Aircraft

A report has been recently spread to the effect that at the last session of the International Commissioners for Aerial Navigation, held at Brussels, Belgium, recently, the nationality mark assigned to Norway, was the letter "N". This letter had been previously designated as the nationality mark of United States aircraft. It was also reported that the new nationality mark for United States aircraft was to be the letter "W".

These reports had been based on a misconception of the decisions taken at Brussels. According to the minutes of the third session of the International Commissioners for Aerial Navigation, the letter "E" was granted to Norway as that country's nationality mark, with the letter "N" as the first letter of the registration mark.

The letter "N" therefore, remains the nationality mark for United States aircraft. This statement is made on the authority of the Controller General of Civil Aviation of Canada in a dispatch to the National Aeronautic Association.

Florida Proposes to Spend $100,000 for Air Terminals

The State of Florida under the terms of a bill now before the Legislature proposes to appropriate $100,000 as a fund for "the aid of aerial transportation into and within the State of Florida", according to information just received by the Aeronautical Chamber of Commerce. The proposal has attracted nation-wide attention, as in the preamble of the bill the principle is recognized that the war investment in American aviation should be realized for the benefit of commerce and industry, through the establishment of public facilities, lacking which, aerial transportation lines cannot reasonably be expected to operate.

It is proposed that the sum "be expended in defraying one half the cost and expenses of buying suitable location for the erection of and in erecting suitable hangars and workshops for the housing and care of the flying machines of bona fide aerial transportation persons, firms or corporations operating" within the State.

© Official Photo U. S. Navy.

Some of the power cars of the ZR-1, the Navy rigid airship, which will be completed this summer

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Conditions imposed are "that one or more countries and / or municipalities of the State of Florida, jointly and severally, directly or indirectly, defray one-half of the expenses of buying locations for the erection of and in erecting the buildings"; and that the respective counties and/ or municipalities defraying one-half of the said expenses........shall govern and control the franchising and leasing gratuitously the respective hangars to bona fide operators. To qualify as a "bona fide operator" an organization must have five or more aircraft utilized in the transportation of passengers, mail or express.

"While subsidies in the form of cash bounties as paid to operators by practically all the European governments, are looked upon with disfavor in the United States", the Aeronautical Chamber of Commerce said, "it has been repeatedly advanced by students of aviation that national policy urges the establishment of public owned and controlled terminals as these constitute probably the major expense in physical equipment and also in the future may be the key to proper regulation or to satisfactory utilization of all our aerial resources for national security. The Experiment is especially interesting because of the lack of surface transportation facilities in the Florida peninsula. Until recently there were few good roads and even now to travel by rail from Miami to Tampa or Jacksonville requires from 12 to 24 hours as compared with a few hours by air. According to reports received by the Aeronautical Chamber of Commerce there were three established aircraft operating activities in the State of Florida in 1920 and 1921 and four in 1922."

Cross Country Flying Made Easy

Airport and landing field maps and "blue books" of the air—everybody fly!

The Airways Section of the Army Air Service has just produced a map of the United States, which, it is hoped, will be freely obtainable by all who have flying to do, on a scale of 1/4,000,000 or 63 miles to the inch, on which are located all Government or Army fields, Navy or Marine aerodromes, Air Mail stations, Municipal airports and all Commercial, Emergency and Seaplane steps. Each type or classification of field above has its dot on the map a distinctive color. In addition, lines have been drawn between centers of population and industry to indicate probable routes for commercial air lines. Some three thousand-plus fields are located on the map. All we need is a supply of commercial airplanes—flying.

Let's put "Hop in Noble" on the country's airplanes for the next Shriners' convention.

Information Circular No. 404 has just been issued by the Army Air Service. This gives a full description of various types of fields, tells how they should be laid out and marked, together with a list of nearly four thousand towns where landings may be made, each field being designated, described, located with altitude reading, and a statement as to the availability of supplies.

Navy Grants Newport Site For New York Air Line

Assistant Secretary of the Navy, Theodore Roosevelt has sent Capt. Frank Taylor Evans word that the Navy Department is pleased with the selection of Coddington Point, its Newport naval cantonment, as the Newport terminal of the air line from New York.

The department, anxious to aid commercial aviation on a project that will attract countrywide attention, will grant use of Government land and buildings as soon as a formal request is received from the city of Newport. Capt. Evans was told that the Navy Department was anxious to co-operate in every way possible, and that further instructions would be sent him upon receipt of the city's request.

The city government is also considering the creation of an air commission to further promote the project that Messrs. Vincent Astor and T. Suffern Tailer started.

Loening Air Yacht in Record Flight

A remarkable record flight was made May 15 by Lt. Chas. B. Austin, U. S. N., Pilot of one of the new Loening flying yachts, with his mechanic H. B. Wiedercamp and Mr. Grover C. Loening.

The flying boat left the Loening airport landing at 31st Street and East River, New York, at 10:30 A. M., and landed at Hampton Roads, Virginia, at one o'clock—two hours and a half later, making an average speed of 120 miles per hour for the distance of 310 miles. This breaks all speed records for flying boats. The machine used in today's flight is of type similar to the fleet of flying boats built this spring for the New York-Newport Air Service, to be operated between New York and Newport this summer.

Contract Awaits New York-Chicago Air Line

The definite offer of an express contract to an airplane line operating between New York and Chicago awaits acceptance, Robert E. M. Cowie, vice-president of the American Railway Express Co. today assured the National Aeronautic Association.

Not only will the American Railway Express Co. enter into a contract with a properly organized air service company, but it will exploit the faster service, advertise rates, pick up shipments at points of origin and deliver them for air transportation at main-line air ports.

"I firmly believe the day will soon come when some well-organized airplane service will be in the field to conduct a regular commercial transportation business between New York and Chicago and other large cities in this country," said Mr. Cowie. "Gradually that day is approaching under the impetus of the informative work carried on by the National Aeronautic Association. I have been approached by many persons interested in air transport, and I have told them all that the need was for establishing the operating line and then we will be immediately ready to make a contract.

"Our idea is that commercial aviation is the next evolution in transportation for light, non-bulky packages of an emergency character, where the saving in time rather than the charge is the controlling factor. I have steadfastly advocated that when a service of this kind is set up it should be installed between New York and Chicago. To make the saving in time substantial," declared Mr. Cowie, "it should contemplate night flying, so that the present schedule by the fastest express trains between these cities, which makes delivery possible on the second day, would be cut in two by affording delivery on the first morning out.

Asked what the traffic between New York and Chicago for an air service would amount to, Mr. Cowie said one could not make a forecast. "It will never be known until it is tried," he added. "Nobody could have predicted with certainty when the telephone first came into use how extensively it would be used," he said.

"The American Railway Express Co. stands ready to consider a contractual arrangement for a service of this kind just as soon as an adequate and dependable airplane service is available. When an air express service between New York and Chicago is inaugurated," he declared, "I feel certain that the public will find a use for it."

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THE AIRCRAFT TRADE REVIEW

Wright Aeronautic Corporation Activities

Two of the most important recent developments in the aeronautical industry are the entry of the Wright Aeronautical Corporation into the field of airplane manufacturing and the acquisition by the Wright Corporation of the Lawrence Aero Engine Corporation of New York City, as contained in the following announcement recently made by Mr. F. B. Rentschler, President of the Company:

"After careful consideration, our company is now providing facilities for carrying on the experimental development of plane types. It is believed that active development of complete units for aircraft will ultimately make for the best product. We expect to have ready for occupation shortly a new plant, constructed alongside our present one, which will house our plane development activities. This plant will be just as modern in every detail as our present one, and will be sufficient to carry out our present program. We are also negotiating for flying facilities at some place adjacent and convenient to Paterson. Because of the intense concentration necessary during the war, it seemed advisable for our company to devote its entire activities to the development and manufacture of aeronautical engines. It was, therefore, quite natural that at the end of the war period we should continue to engage principally in the manufacture and development of engines. It is, of course, entirely consistent that the organization bearing the name of Wright should eventually resume the development and manufacture of complete airplanes.

"The Wright Aeronautical Corporation announces that it has acquired by merger the assets and business of the Lawrence Aero Engine Corporation. By this acquisition, the Wright Company adds to its present line of water cooled airplane motors the Lawrence line of air cooled motors. The Lawrence Company has been the pioneer for some years in the development of air cooled motors and today has the only fully developed line of air cooled airplane motors now being produced in this country. At least, for the smaller powers, this type of motor has been becoming steadily more prominent for airplane use. Therefore, the acquisition of the Lawrence Company by the Wright Company should materially broaden the market for the Wright Company. Charles L. Lawrence, who has been successful in the development of the Lawrence Company business will become Vice-President of the Wright Company and will continue his active work in the development of airplane motors through the medium of the enlarged Wright Aeronautical Corporation."

Curtiss Planes in China

The Great China Airways Company will use 24 Curtiss machines to operate over five routes. The first route, expected to be opened shortly, will be from Tientsin to Peking, to Kalgan and Uruga. The second line is planned from Shanghai to Chengtu with a stop at Hankow.

The Government has agreed to permit the use of government landing fields at Peking and Tientsin in order to encourage commercial aviation.

This is the first legal sale of American planes to China in competition with the British, except for six Curtiss planes sold last year for training purposes.

Aeronautical Chamber of Commerce Membership

Practically every concern and individual belonging to the Chamber during 1922 has continued its membership. There are now well over two two hundred (200) members in the three classes.

Among those who recently acquired membership, are the following:

CLASS "B"

Aircraft Development Corp., General Motors Bldg., Detroit, Mich., American Gas Accumulator Co., Elizabeth, N. J., Eberhart Steel Products Co., 812 E. Ferry St., Buffalo, N. Y., Great Lakes Aerial Photographic Co., 11511 Mayfield Road., Cleveland, O.,Haskelite Mfg. Corporation, 819 Chamber of Commerce Bldg., Chicago, Ill., Luftschiffbau-Zeppelin, Mr. Harry Vissering, American Rep., 14 E. Jackson Blvd., Chicago, Ill., Sperry Gyroscopic Co., Manhattan Bridge Plaza, Brooklyn, N. Y., U. S. Touring Information Bureau, Inc., Waterloo, Iowa, Wyman Gordon Co., Worcester, Mass.

CLASS "C"

Richard H. Depew, 136 W. 52nd St., New York City, Orton Hoover, Curtiss Aeroplane Export Corp., c/o U. S. A. Consulate, Rio de Janeiro, Brazil, C. S. Jones, Curtiss Aeroplane & Motor Corp., Garden City, N. Y., Lawrence Leon, Curtiss Aeroplane Export Corp., 818 Via Monte, Buenos Aires, Argentina, Fred M. Ruddell, Kokomo, Indiana. S. Albert Reed, 113 E. 55th St., New York City, H. Von Thaden, Aircraft Development Corp., General Motors Bldg., Detroit, Mich.

Contract Awarded to L-W-F Engineering Company

Three contracts for 56 planes at a total cost of $829,870.10 have been awarded to L-W-F. Two of the contracts are for the Navy and the other for the Army, according to recent press reports.

An award of $3,500 was made to the L-W-F Engineering Company for their design for Type T-3 plane. This type plane is designed primarily for Army transport work, carrying six passengers and a crew of two with baggage. They can readily be converted into bombers or to carry over a ton of freight.

One of the Navy contracts is for 20 torpedo planes, type LT-2 biplane. The second Navy contract is for 26 Type 1, 3 seater observation planes. The company is just completing a contract for 35 Martin bombers.

At the present time L-W-F employs 350 skilled workmen.

U. S. Touring Information Bureau, Inc.

Among those organizations that have recently acquired membership in the Aeronautical Chamber of Commerce is the U. S. Touring Information Bureau. In co-operation with the Chamber, the National Aeronautic Association and the War Department the Bureau has compiled comprehensive data on landing fields throughout the United States and has printed an addenda to their regular directory, and a specially prepared map showing the location of some 3000 improved and unimproved landing fields.

State Legislation

Failure of Congress to pass the Winslow Bill, providing for a Bu-

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reau of Civil Aeronautics in the Department of Commerce, lead to consideration by many State Legislatures of an Aviation Code which was inadequate to meet the situation.

The Aeronautical Chamber of Commerce, through its various State Committeemen and in co-operation with the National Aeronautic Association, have pursuaded several State Legislatures to withhold final action on such legislation.

One particular instance is the case of the Pennsylvania State Legislature where, through the co-operation of the Aeronautic Association and our State Committeeman, Mr. W. Wallace Kellett, who is President of the Pennsylvania Aero Club, the Legislature was pursuaded to withhold passage of an Aviation Code until after the conference arranged by the National Aeronautic Association with the Commissioners on Uniform State Laws, which is called for next August.

Loening Air Yacht Record Flight

Mr. Grover C. Loening in one of the new Loening flying boats made a non-stop flight from New York to Hampton Roads, 310 miles, in two and one half hours, at an average speed of 120 miles an hour.

U. S. Chamber of Commerce Advocates Federal Legislation Governing Aircraft

At a meeting held in New York on May 10th, of the U. S. Chamber of Commerce, of which the Aeronautical Chamber of Commerce is a member, the following resolution was passed:

"Aviation has demonstrated great possibilities for the addition of new services to commerce and important means of national defence. That these possibilities may be developed and their national benefits obtained, commercial aviation should receive prompt and sustained encouragement. As requisite to this end, suitable legislation should immediately be enacted by Congress to govern the flight of aircraft and the airways over which they operate."

Commercial Operations in Colombia, S. A.

Mr. James Otis of 310 California Street, San Francisco, California, an exporter, recently visited the office of the Aeronautical Chamber of Commerce and furnished some very interesting information and photographs of aviation activities in Colombia, South America.

Mr. Otis has extensive business interests in South and Central America and during his last trip he made a special study of the efforts being made by a group of Germans to extend aeronautical activities in that territory.

The enterprise was started upon the initiative of the German Consul at Bogota, Colombia, who secured a considerable amount of capital, fifty per cent of it being contributed by Germans living in Colombia and the balance by native Colombia bankers and commercial houses having foreign interests.

Sociedad Colombo—Alemanade Transportes Aereos is the name of the line. It operates over a 600-mile route up the Magdalena River, starting from Barranquilla and ending at Guardot.

The equipment consists of six all-metal Junkers equipped with pontoons.

The line is heavily patronized for the transportation of mail, freight and passengers. During the year 1922, 205,990 kilometers were flown in 1567 hours and 46 minutes, a total of 526 flights. 1137 passengers were carried and 4,834 kilograms of mail and 1143 kgs. of parcel post.

The company has the privilege of issuing and selling its own postage stamps and charging whatever rate it wishes for the transportation of mail.

The company employs 30 persons, 29 of whom are Germans.

New Farman Undercarriage

We present a view of the new Farman undercarriage on the 1923 Farman Sport plane and other Farman models. The principle of this new landing gear is quite simple and apparent.

The landing gear wheels and their axle are placed not as usual at the point of the "V" of the landing gear strut, but some distance ahead of this point. A wooden ski connects each wheel with the "V" strut of the landing gear and runs on back to the ground. The ski is attached to the "V" strut by a cable in front and rear.

This arrangement moves back considerably the center of gravity of the machine behind the point of contact of the landing gear wheels. The weight of the machine is equally distributed between the wheels and the heels of the skis, which act as a brake and eliminate long rolling of the machine.

It is also possible to make a quick take-off, as the motor will run full out, and the tail of the machine is raised, thus releasing the brake or ski and sending the machine off very quickly. In actual tests, landings have been made without difficulty in 20 ft. and take-offs in the space of some 60 ft.

It is almost impossible to nose this machine over even when making a landing in a ploughed field.

The new Farman undercarriage

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Ludington Exhibition Company

This Company has been formed for the purpose of demonstrating and exhibiting the 1923 model Sport Farman 2 seater. At present, flying is being done from the field of C. S. Ireland, Curtiss Eastern distributor, at Pine Valley, N. J. twelve miles East of Philadelphia.

The performance of this little ship has attracted considerable attention. Its span is 23 ft. 3 in. and its length 19 ft. 11 in. The weight empty is 450 pounds and loaded 890 pounds, the useful load being 350 pounds. This Company is using the 6 cylinder 60 H. P. Anzani motor. It appears to be eminently satisfactory and produces a maximum speed of 85 miles per hour at just over 1250 r. p. m., while the ship has been flown at 800 r. p. m. at speeds around 30 miles per hour with the greatest ease. The climbing ability is remarkable being in the neighborhood of a thousand feet a minute. The operating costs are extremely low, the fuel consumption being less than four gallons an hour.

It is planned to enter this machine in all events for which it is eligible at every officially sanctioned meet it can attend. Although the Sport Farman is capable of performing every known acrobatic maneuver, it is the policy of the Company not to permit its use for stunting purposes and to acquaint the public in every possible way with the safety of properly controlling flying. The Company is anxious to be notified of any and all meets that are to be held during the coming season, so that it may complete its schedule.

The officers of the Company are: C. T. Ludington, President and Treasurer. W. S. Ludington, Vice-President. W. Wallace Kellett, Secretary. Robert P. Hewitt, Pilot.

Aero Exposition in Detroit

With the opening of the Detroit Coliseum at the fair grounds as an all year round exposition building, plans are now being perfected for the holding of the first annual Airplane Exposition ever staged in the Michigan metropolis in the new structure from December 5th to 9th, this year.

The exposition will be for the entire state industry, and will have the attention of all branches of the trade throughout the state. Invitations are being sent to Ohio and Indiana organizations to join in the movement and very favorable responses have been had to date from several of the big bodies, with a view of developing a TRI-STATE organization at the show.

The Coliseum is the finest exposition building in America and next to the Olympia, the largest in the world for affairs of this kind. It lends itself easily to decorations and by a series of terraces can hold an exposition of 300 exhibits on one floor where every exhibitor's sign is visible to the entire gathering at the same time. There are numerous convention halls, complete banquet halls and committee rooms to accommodate any kind of emergency.

Mail Flier Proposes Trans-Continental Flight

Request for official recognition by the contest committee of the National Aeronautic Association of an air mail pilot's attempt to make a continuous flight alone from San Francisco to New York has been received at national headquarters of the association. The request was filed by A. C. Nelson, of Salt Lake City, superintendent of Western division, U. S. Air Mail Service.

The pilot, Clare K. Vance, of Logansport, Ind., is preparing to start within ten days upon this initial attempt in his own airplane to negotiate a non-stop transcontinental dash which he hopes to make in 20 hours.

Vance's airplane, which he built himself, weighs fully loaded 4,200 pounds and has a gas capacity of 350 gallons. Its maximum speed is 122 miles per hour and it is capable of climbing 13,000 feet. He plans to leave San Francisco at 10 o'clock at night and land in New York at 6 o'clock the following evening, taking the route through Omaha, Chicago, Cleveland.

His friends in the Air Mail Service are confident of his success and are hopeful that it will gain for Vance public recognition by the award of a purse for his hardihood. While Vance is on leave of absence from his mail duties, and his flight is in no way a part of the postal activities, his friends consider that if successful the flight will be the greatest performance in American aeronautics to date, and they are seeking to arouse interest in public recognition through a substantial reward.

Vance last February in a snowstorm made the first successful landing of an airplane on the crest of the Sierra Mountains after battling a 90-mile gale; he made his way to the Reno railway station with 300 pounds of mail and completed his trip to San Francisco by rail.

Metals and Their Alloys

Though "Metals and Their Alloys" (Charles Vickers) is merely a revision of a former edition, some chapters have been added based on a book called "Metallic Alloys" by Brannt. This has made the edition so much more complete, that practically a new book has resulted. The manner in which the new information is presented is superior to Brannt's method of presentation.

Charles Vickers is a practical foundryman who has for many years been in intimate contact with metals and metallurgical processes and has learned to know those problems that most frequently baffle the users of metals. His book gives some attention to chemical control and physical tests, but as a whole the author has refrained from technical discussions and the language he uses is that of the practical man talking to practical men. The chapters dealing with the recent developments of magnesium alloys and die-castings are particularly interesting.

Some of the chapter heads are as follows: Aluminum and Its Alloys, Copper-Tin Alloys, Steam and Electric Railroad Alloys, Manganese Bronze and White Brass, Nickel Alloys and Monel Metal, Foundry Utilization of Scrap Metals. In addition to these and several more interesting chapters, you will find a Glossary of Terms Used in the Foundry.

This book will probably meet with an enthusiastic reception from every one interested in the subject of metals. (Published by Henry Carey Baird & Co., Inc., 2 West 45th Street, New York.)

Air Ambulance Renders Assistance at Cape Hatteras

Another instance of medical assistance by air being rendered to outlying and inaccessible spots by naval airplane is furnished in a recent report from the Naval Air Station, Hampton Roads. A radio call from Cape Hatteras recently advised of the serious illness of Mr. T. J. Farrow. One of the station seaplanes was at once dispatched with a doctor and Mr. Farrow was brought back to the Protestant Hospital in Norfolk. Due to quick action and the speedy means of supplying medical attention afforded by airplane, it is said that the patient's life was saved.

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ARMY and NAVY AERONAUTICS

Navy Fliers Make 17 World Records

American naval fliers, contesting at San Diego in events never before put on an official program, on June 7, established seven more world records in addition to the two they broke and the eight others they established yesterday, making a total of seventeen world records now held by the aircraft squadrons of the battle fleet here.

What naval fliers regard as a striking achievement was that of an F-5-L plane of the coastal mail type, which, piloted by Lieutenant H. E. Halland, lifted an extra weight of 2,000 kilograms (about 4,400 pounds), 5,200 feet. The total weight of the machine and load was 14,400 pounds.

This flight, said to be one of, if not the best of the kind, was made with a Liberty motor.

Another thrilling flight for an altitude record was made by Lieutenant Ralph Ofstie in a T-5 battle plane, with single seat and no extra load. He soared to 18,400 feet, encountering a temperature of two degrees below zero. The air was so rarefied that the air in the pontoons of the machine was largely sucked out and when the T-5 began to descend the pressure of the atmosphere without caved in the pontoons. The flight established a record.

Another record was made by Lieutenant Earl Brix, flying a torpedo plane, with an extra weight of 250 kilograms, to an altitude of 12,050 feet.

A world's record for seaplanes over a three kilometer course was established by aviators of the air squadrons of the battle fleet when Boatswain E. E. Reber, piloting a torpedo seaplane, attained a speed of 102.88 miles an hour.

Lieutenant L. D. Webb was second in the tests, making 102.78 miles an hour. He flew in an M-O monoplane recently added to the aerial equipment of the North Island naval air forces.

Lieutenant G. T. Cuddihy was forced to land when his T-S plane lost a propeller. He escaped injury.

Sets Helicopter Record

Pescara succeeded in making a flight of 121 meters in a helicopter on June 7, at Issy les Moulineaux. The previous record was 83 meters. Pescara's flight of 121 meters is equivalent to approximately 397 feet.

Langley Field Pilots Start Night Flying

The 2nd Bombardment Group at Langley Field, Va., has entered upon the program of night flying prescribed by the Chief of Air Service. On their first night a brilliant full moon favored the pilots, but it persisted in hiding itself behind heavy cloud banks every few minutes. Only the hangar flood lights and a field lighting set were used in illuminating the landing field. Two dual NBS-1's were used during the week, in order that every pilot could be given a check ride and a few landings. A large circle of red and white lights used in conjunction with illuminated panels regulated traffic. The present schedule calls for flying three nights a week regardless of the moon, and as soon as the pilots become proficient in landing, camera obscura flights will be made.

More DH4B Airplanes To Be Put in Commission

The shipment from the San Antonio Air Intermediate Depot, Kelly Field, Texas, of 130 DH-4 airplanes without motors to the Gallaudet Aircraft Corporation, Witteman Aircraft Corporation, Lawrence Sperry Aviation Corporation and Cox-Klemin Aircraft Corporation was completed on April 25th. These planes are to be remodeled into DH4B's, to be utilized in servicing the various Air Service fields, as the demand for this type is urgent. Mr. Roger Q. Williams, the joint representative of the four aircraft corporations contracted to remodel these ships, supervised the inspection and shipment of the planes.

New Airship Tested at Scott Field

The new airship of the SST type, which was recently completed at Scott Field under the supervision of Charles Brannigan, Chief Engineer for the Scott Field Air Intermediate Depot, was tried out on a test flight of one hour. The ship handled well and responded quickly to the controls. Its crew consisted of Lieuts. Chas. P. Clark, R. S. McCullough, pilots; and Mr. Charles Brannigan.

The capacity of the new airship is 100,000 cubic feet; length, 165 feet; height, 49 feet; width, 35.5 feet; speed, full cruising, 57.5 m.p.h.; useful load, 2240 lbs. Two Rolls-Royce, hawk type motors of 75 h.p. each furnish the motive power.

© Photo U. S. Army Air Service.

Target glider of the U. S. Army Air Service mounted on a "Jenny"

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New Pursuit Airplane for the Army Air Service

Residents of the National Capital had an opportunity recently to view the latest type of pursuit airplane built for the Army Air Service by the Curtiss Airplane and Motor Corporation. The plane, piloted by Lieut. Wendell H. Brookley, Air Service, landed at Bolling Field from Mitchell Field, L. I., New York, making the trip in two hours and 20 minutes in the face of an adverse 15-mile wind. It is, of course, capable of much greater speed, but leaving New York in company with another plane it had to fly at reduced speed so as not to lose her less speedy companion, the pilot being forced to cut down the revolutions of his propeller from its maximum of 2250 per minute to 1450. Incidentally, the accompanying plane had engine trouble when over Baltimore and was forced to land in the Monumental City, arriving at Bolling Field an hour and a half later.

The general public conversant with the various high speed airplane records recently established by the Army Air Service has no doubt cast a questioning eye on the bearing these so called sporting events had on military aviation. The answer may be found in the advent of this new airplane. While this ship has all of the characteristics of the Curtiss Racer in which Lieuts. Maughan and Maitland startled the world with their ultra speed performances, it is, unlike the racer, designed for extremely efficient performance at high altitudes. This fact has necessitated the addition of more lifting area, which naturally materially cuts down its speed. In a recent flight an Army pilot drove this plane 152 miles an hour at an altitude of 15,000 feet.

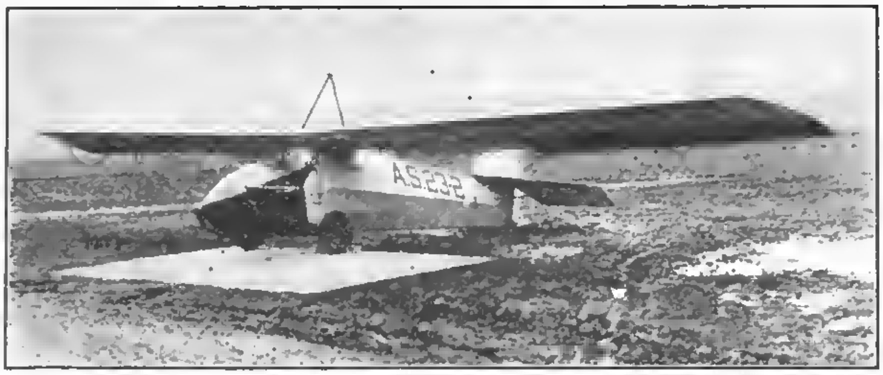
One of the outstanding features of the plane is its remarkable climbing ability. From the take-off she can climb 2500 feet in one minute, or at the astounding rate of 30 miles an hour; 1710 feet per minute from 6500 feet and 1390 feet per minute from an altitude of 15,000 feet. At the maximum altitude possible of attainment with its normal equipment (28,600 feet) it can skim along in this rarefied atmosphere at 113 miles an hour. At ground level the plane can "hit it up" at 169 miles an hour, some 17 miles per hour faster than the speediest pursuit ship now in service. Army Air Service officials contend that when equipped with a high-speed propeller the plane should better this mark considerably. At 20,000 feet altitude the plane can still rival the speed of its nearest competitor at ground level, being capable of traveling at the rate of 2½ miles per minute. The propeller of the plane delivers its maximum number of revolutions per minute (2250) at an altitude of 6500 feet.

Like the Curtiss Racer, this new pursuit ship is equipped with a Curtiss CD-12 engine, delivering 400 horsepower with very little vibration, thus indicating the skilful engineering put on the job. The weight of the plane empty is 1879 pounds, loaded 2784 pounds. The overall length is 22 feet, 10 inches; height, 8 feet, 8 inches; wing span 32 feet; positive stagger of wings, 34 inches; chord of upper wing, 5 feet; chord of lower wing, 4 feet; gap, 4 feet, 7 inches. The total wing area is 265.3 square feet. The landing speed is 61.5 miles per hour; 86 gallons of gasoline can be carried, which gives a cruising radius extending well over the two hours required for pursuit ships.

Extreme accessibility of vital parts is carried throughout the ship. The fuselage of steel construction may be opened in sections, with the greatest ease, by withdrawing a safetied rod, and all the engine parts can be quickly inspected or repaired with the minimum time and labor spent in the removal of the cowling.

The cockpit and wings are so arranged that the pilot obtains the greatest possible angle of vision. The landing gear axle hubs have shock absorbers, and the V-shaped axle feature enables the ship to land in rough terrain with the least risk.

General Wm. Mitchell, Assistant Chief of Air Service, one of the first pilots to fly the new ship, was well pleased with its performance, his comment being that "She runs like a sewing machine."



The McCook Field Glider "G. L. II"
© Photo U. S. Army Air Service.

Parachutes to be used on Cross Country Flights

The regular emergency parachute is now being issued at Kelly Field, upon request, to all pilots starting on cross-country flights. As soon as a sufficient number is obtained they will be required to be carried on all flights. Instruction in the packing of parachutes has been carried on at the field for the past month.

Test Over 3-Kilometer Course

Shortly following the one-kilometer and other test flights at Wilbur Wright Field, Dayton, Ohio, which resulted in a wholesale emigration of world's records from France to the United States, Lieut. Lester J. Maitland, Air Service, flew the three-kilometer course at a speed of 234.64 miles per hour. Because of the wind, however, but two crossings of the course could be made. In a second attempt two days later, Lieut. Maitland's plane met with an accident. The wheel was broken upon striking a rut, when the plane had taxied about 100 yards preparatory to a take-off. The airplane nosed over, cracking up the propeller and wings. To the great good fortune of the Air Service and of all who know him, Lieut. Maitland escaped uninjured. The propeller, which was used interchangeably on the ship flown by Lieut. R. L. Maughan as well as the one flown by Lieut. Maitland was the only one of its kind in existence, having been built especially for the R-6 Racers. A duplicate is already in course of construction, and it is hoped the other repairs to the airplane may soon be completed. Because of the broken propeller, Lieut. Maughan's flights also had to be postponed. Both of the pilots will again fly the three-kilometer course, however, as soon as the new propeller is available, and very interesting results are expected.

Another Non-Stop Flight Record

What is believed to be another record in the history of aviation in the United States was made by a Scott Field crew, flying in a new non-rigid airship, the AC-1, from Langley

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Field, Va., to Scott Field, without a stop.

The AC-1 glided away from Langley Field at 2:36 p.m. Eastern time, Wednesday, May 2nd, and landed at Scott Field at 7: 00 a. m. the next day, having traversed the distance of about 800 miles in 17 hours and 24 minutes.

The crew of four Lieutenants and two Sergeants cooked their meals, played cards by electric lights, slept in bunks and shaved on the way. They wore ordinary uniforms, not the cumbersome flying togs, and were comfortable, despite the fact that the night was chilly and the atmosphere so foggy that the compass was their only guide.

The crew of the ship were Lieutenants C. W. McEntire, W. C. Farnum, R. S. Heald and A. H. Foster, Sergeants Brasty and Kerzoski.

The AC-1 is at present considered the Army's fastest airship, it's speed with full throttle being 67 m.p.h., 7 miles an hour faster than any other airship now in service. It has recently completed a series of experimental flights with helium gas, but has now been inflated with hydrogen gas. The length of the ship is 170 feet, the diameter 48 feet, and the gas capacity 190,000 cubic feet. It carries 330 gallons of gasoline, an amount sufficient to carry it for 30 hours at a 50 mile per hour cruising speed.

A special feature of the airship is an inclosed car, the first of its kind built in this country. It contains two rooms, the forward compartment being used for the operating cabin and crew's quarters, while the rear compartment carries the power plant. Two Aeromarine engines of 180 h. p. each furnish the motive power. The engines deliver their power through a transmission to two propellers which are carried on outriggers, one on each side of the car. The propellers operate at one-half engine speed. A reverse gear is attached to this transmission, which facilitates the maneuvering of the ship in landing.

In the engine room is also located a coffee percolator and a rather complete kitchenette. There is ample space for the crew to get the necessary sleep on good comfortable mattresses, with plenty of blankets, and to have the necessary shave in the morning. There are complete lavatory and toilet facilities. With the closed cabin and the absence of noise, it is not necessary for the crew to wear helmets, goggles, ear protectors, flying suits, and all the paraphernalia necessary in open type of aircraft, and conversation can be carried on without raising the voice.

Floodlight Used as a Signalling Device

An interesting experiment, and one which may prove of permanent value, was recently tried out at Mitchell Field, L. I., New York. An ordinary floodlight was connected with an electrically driven device which automatically made and broke the circuit. By flashing two dashes of three seconds each and two dots of one-half seconds each it was possible to spell out M I, the first two letters of the word MITCHELL, in the Morse International Code at intervals of twenty seconds. So far as is known, this is the first attempt made to positively identify a landing field to a pilot flying at night. In addition to the fact that the International Code is universally recognized, this system has economy in its favor, as the one light is lit less than one-half the time.

To accomplish this result by other means it would necessitate spelling out letters and symbols which would require several lights of the same candle power to secure equal visibility. A disappearing light would also be much more apt to catch a pilot's eye than a permanent light, due to the number of permanent lights which are visible in certain localities.

Captain Ira C. Eaker flew for nearly an hour to determine the effectiveness of the signals and upon landing stated that they were easily read from comparatively close range. The lack of range is attributed to the low candle power of the light used and the inability to secure a proper searchlight effect.

Plans are under way to use a stronger light and with certain improvements suggested by the experiment conducted, it is hoped to attain a visibility of ten miles. When same is achieved it is believed that this system will be a valuable aid to night flying.

Department of Photography Operating at Air Service Technical School

On March 5th last, the Department of Photography of the Air Service Technical School at Chanute Field, Rantoul, Ill., began the instruction of the first class in photography at that field. This department, formerly the Air Service School of Photography, was removed last summer from Langley Field to Chanute Field, and with the Communications and Mechanics Schools consolidated into the present Air Service Technical School.

The Photographic Department occupies two of the wooden type of hangars, the interiors of which, affording over 15,000 sq. ft. of floor space, having been partitioned into offices, work rooms and laboratories thoroughly equipped with necessary electric illumination, power, water supply and ventilation systems. The present school facilities are a decided improvement over those that existed at Langley Field, in that badly needed laboratories and work rooms are now afforded, and their arrangement is with reference to a clearly defined course of instruction and is not an attempt to adapt rooms in a building erected for other purposes to photographic school uses.

The course of instruction has been greatly enlarged and improved, and it is expected that later, in the form of the training regulations on photography, it will be available for training purposes in the Air Service. The course of instruction for officers of the Regular Army is 725 hours in length, or approximately 24 weeks; for Reserve Corps officers, three

Army airship A-C1, which made a non-stop flight from Langley Field, Va. to Scott Field on May 2-3.

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months; and for enlisted students 408 hrs., or approximately 14 weeks. These courses differ one from the other not only in length of time required, but also in the subjects given. The course for Regular Army officers comprise instruction in 15 subjects; that for Reserve officers, 14 of these subjects, and that for enlisted men, 11 of the subjects. The eleven subjects which are common to the three courses—although the amount of time devoted to a subject varies with the course—are as follows: Elementary photography, photographic chemistry, negative making processes, printing processes, photographic optics, cameras, practical ground photography, copying, mosaic making, filters, and the work of a photo section. In addition, the course for Regular and Reserve officers includes practical aerial photography, the military uses of aerial photographs, photographic interpretation and aerial intelligence, and in the case of Regular officers only elementary topography.

Naval Planes will Make Extensive Survey of Alaskan Airport Facilities and Natural Resources

An extensive survey of Alaskan territory, with a view to ascertaining data on airports, airbases, and general coast line information of value to aviation projects, will be made this summer by two Navy DT seaplanes which will be attached to the commission headed by Rear Admiral Chase. The planes will leave San Diego, on May 25th, and will base on the USS CUYAMA during their operations in Alaskan waters. It is expected that information of value to conservation and development projects will be obtained in this manner from the air in territory and over terrain that is otherwise almost inaccessible. In addition to the survey that will be made in connection with airport and landing field facilities for government aircraft, photographic maps will be made and information will be gathered which will be of great value to the Coast and Geodetic Survey and the Alaskan Coal Commission. Aerial maps will be made by the planes which will furnish what would otherwise take months to obtain. Some of this information would be unobtainable except by the use of aircraft. One of the projects which will be undertaken is the completion of a difficult piece of triangulation for the Coast and Geodetic survey which by air will be accomplished in hours where weeks and months would be required if methods were used that have served in the past. The proposition is to establish triangulation points on Baranoff Island by aerial photography which may be used to plot in the territory from one coast to another. According to officials of the Coast and Geodetic Survey this work would require months of mountain climbing unless it is accomplished by naval planes.

It is also planned to make a survey of the Alaskan Oil Fields and of the Seal herds on the Alaskan Coast and in the surrounding waters. The planes that have been selected for this duty are the new service DT torpedo and bombing planes which have shown such exceptional qualities for service use. The fact that they may be used for such extensive peace time duties is considered as an added proof of their value for service use. The planes will be piloted by Lieutenants E. B. Brix and J. H. Stevens, U. S. Navy. They will carry a full equipment of photographic material including mapping camera and special high power lenses for distance work.

Crews of the four Martin Bombers flown across the continent from San Diego to Washington.
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N. A. C. A. Publications

Reports

No. 143. Analysis of Stresses in German Airplanes, by Wilhelm Hoff. An exhaustive paper of 52 pp., with bibliography. 15c.

No. 136. Damping Coefficients due to Tail Surfaces in Aircraft, by Lynn Chu, of M. I. T., condensed and modified by Edward P. Warner. 14 pp. 5c.

Eighth Annual Report of the N. A. C. A., for 1922. Administrative Report, without Technical Reports. 52 pp.

No. 151. General Biplane Theory, by Max M. Munk, 47 pp. May be had for 10 cents from the Superintendent of Documents, Washington, D. C.

No. 156. The Altitude Effect on Air Speed Indicators-11, by H. N. Eaton and W. A. MacNair. A continuation of Report No. 110. 46 pp., with charts and illustrations. Available from Superintendent of Documents, Washington, D. C., at 10 cents.

No. 157. Nomenclature of Aeronautics. 59 pp., illustrated. Obtainable from the Superintendent of Documents, Washington, D. C., at 10 cents.

No. 158. Mathematical Equations for Heat Conduction in the Fins of Air-cooled Engines, by D. R. Harper 3rd and W. B. Brown. 31 pp. May be had from Superintendent of Public Documents, Washington, D. C., at 5 cents.

No. 159. Jet Propulsion for Airplanes, by Edgar Buckingham. 18 pp. Copies may be had at 5 cents from Superintendent of Public Documents, Government Printing Office, Washington, D. C.

No. 167. The Measurement of the Damping in Roll on a JN4h in Flight, by F. H. Norton. 6 pp. From Supt. Public Documents at 5 cents.

Technical Notes

No. 113. Report on the General Design of Commercial Aircraft, by Edw. P. Warner, of M. I. T. 19 mimeographed pages.

No. 120. A Preliminary Study of Airplane Performance, by F. H. Norton and W. G. Brown, of the N. A. C. A. laboratory. 7 pp. mimeographed, and 5 pp. illustrations.

No. 121. Further Information on the Laws of Fluid Resistance, by C. Wieselsberger. From Physikalische Zeitschrift. 8 mimeographed pp. and 3 pp. charts.

No. 122. The Determination of the Angles of Attack of Zero Lift and of Zero Moment, based on Munk's Integrals, by Max M. Munk, N. A. C. A. 9 mimeographed pp. and 2 pp. charts.

No. 123. An Optical Altitude Indicator for Night Landing, by John A. C. Warner, of Burcau of Standards. 5 mimeographed pp.; 2 pp. ills.

No. 124. Downwash of Airplane Wings, by Max M. Munk and Gunther Cario, 9 mimeographed pp. and 3 pp. of charts.

No. 125. Results of Experimental Flights at High Altitudes with Daimler, Benz and Maybach engines to Determine Mixture Formation and Heat Utilization of Fuel, by K. Kutzbach. A translation from Technische Berichte.

No. 126. Absolute Dimensions of Karman Vortex Motion, by Werner Heisenberg. Translation from Physikalische Zeitschrift.

No. 127. The Air Propeller, Its Strength and Correct Shape, by H. Dietsius. A translation from Technische Berichte. 9 mimeographed pp., 3 pp. of illustrations.

No. 128. Tests on an Airplane Model, AEG D-1 of the A. E. G. company. Conducted at Göttingen Model Testing Laboratory, by Max Munk and Wilhelm Molthan, from Technische Berichte. 4 pages of text and 26 pp. of tabulations and charts.

No. 129. Notes on Aerodynamic Forces on Airship Hulls, by B. L. Tuckerman. Mimeographed. 27 pp. text, 7 pp. ills.

No. 130. Model Supports and Their Effect on the Results of Wind Tunnel Tests, by David L. Bacon. 7 mimeographed pp. text and 6 pp. diagrams and charts.

No 131. Variation in the Number of Revolutions of Air Propellers, by W. Achenbach. From Technische Berichte. 7 mimeographed pp.

No.132. The Increase in Dimensions of Airplanes: Weight, Area, and Loading of Wings, by E. Everling. 27 pp. and 5 ills., mimeographed. Translated from Technische Berichte.

No. 133. Disturbing Effect of Free Hydrogen on Fuel Consumption in Internal Combustion Engines, by A. Riedler. From Technische Berichte. 5 pp. mimeographed.

No. 134. Standardization and Aerodynamics, by Wm. Knight, Prof. L. Prandtl, Prof. von Karman, Col. Ing. Costanzi, W. Margoulis, Lt.-Col. Ing. R. Verduzio, Dr. Ing. Richard Katzmayr, E. B. Wolff and Dr. A. F. Zahm. 98 pp. mimeographed. From Aerial Age of various issues.

No. 135. Measuring an Airplane's True Speed in Flight Testing, by W. G. Brown. 10 pp. mimeographed text; 4 pp. ills.

No. 136. Is There Any Available Source of Heat Energy Lighter than Gasoline?, by P. Meyer. From Technische Berichte. 6 pp. mimeographed.

No. 137. Experiments with Fabrics for Covering Airplane Wings, by A. Pröll. Translated by N. A. C. A. from Technische Berichte. 18 pp. mimeographed text; 17 pp. charts.

No. 138. Determination of the Value of Wood for Structural Purposes. A communication from the Material Testing Laboratory of the Royal Technical High School at Stuttgart. By Richard Baumann. Translated from Technische Berichte. 10 pp. mimeographed text; 3 pp. photostats and charts.

No. 139. Influence of Ribs on Strength of Spars, by L. Ballenstedt. From Technische Berichte. 18 pp. mimeographed text; 6 pp. charts.

No. 140. General Theory of Stresses in Rigid Airship ZR-1, by W. Watters Pagon. 43 pp. mimeographed text; 3 pp. diagrams.

No. 141. Experiments with a Built-in or Fuselage Radiator, by C. Wieselsberger. Translated from Technische Berichte. 15 pp. mimeographed text and charts.

No. 142. Adaptation of Aeronautical Engines to High Altitude Flying, by K. Kutzbach. Translated from Technische Berichte. 30 pp. mimeographed text and 15 pp. diagrams.

List of Navy Publications

Following is a list of Navy publications on aeronautics, continuing the series of catalogs and available government publications already printed in Aerial Age.

Technical Orders

1 Care of Aircraft Propellers During Storage and Use.
2 Operating Temperatures Aviation Engines.
3 Wright Engines.
4 Geared Liberty Engines.
5 Dixie Magneto Switches, Aero Type, as Installed with Magnetos. Care to be Observed in Operation.
6 Breather Holes in Pontoon Handhold Plates.
7 Joints made with Casein Glue.
8 Inspection of Bonding.
9 Longitudinal Dihedral of Type F-5-L Boat Seaplanes.
10 Thread for Sewing of Seams in Airplane Fabric.
11 Use of Commercial Motor Gasoline (low test) in Aircraft Engines in Emergency.
12 Notes on Flexible Gasoline Pipe Connections.
13 Care in Handling of Wing Panels to Prevent Breaking of Air Speed Meter Tubing.
14 Flying of the DH-4 Airplanes.
15 Model VE-7 Airplane. Change No. 81 Elevator Control Leads.
16 Cancelled.
17 Installation of Leads from Pressure Fire Extinguishers.
18 Change in Standard Propeller Design for F-5-L and PT Seaplanes.
19 Venting Gravity Gasoline Tanks.
20 Oil Pressure Gage Connections.
21 Liberty Engine Gear Inspection Hole.
22 Installation of Screen Over Outlet Fuel Line.
23 Use of Aluminum and Aluminum Alloys in Fuel Systems for Airplanes.

Aeronautical Specifications

1—B. Cellulose acetate dope.
2—A. Cellulose nitrate dope.
3—A. Spar varnish.
4—B. Naval gray enamel.
5. Black enamel.
6—A. Dope solvent.
7—A. Wire and cable enamel.
8. (Withdrawn.)
9—A. Wood filler.
10. (Withdrawn.)
11—B. Hide glue certified for use in airplane construction.
12. Linen for airplane covering.
13. Mercerized-cotton airplane fabric (grade A).
14—C. Rubberized fabric.
15—C. Water-resistant panels or plywood (grades A and B).
16. (Withdrawn.)
17—A. Chemical compositions of standard aeronautical steels.
18—A. Tolerances on steel bars, sheets, tubes, wires, and cables.
19—A. Cold-drawn or cold-rolled carbon-steel bars.
20—A. Medium carbon-steel bars and billets (70,000 TS).
21—B. Medium carbon-steel bars and billets (80,000 TS).
22. Half-hard carbon-steel bars and billets (80,000 TS).
23. (Withdrawn.)
24. Alloy-steel bars and billets (100,000 TS).
25—A. Alloy-steel bars and billets (125,000 TS).
26—A. Alloy-steel bars and billets (150,-

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000 TS).
27—A. Alloy-steel bars and billets (175,000 TS).
28—A. Alloy-steel bars and billets (200,000 TS).
29—A. Alloy-steel bars and billets (225,000 TS).
30—A. Alloy-steel bars and billets for casehardening (130,000 TS).
31—A. Alloy-steel bars and billets for casehardening (160,000 TS).
32—A. Alloy-steel bars and billets for casehardening (180,000 TS).
33. (Withdrawn.)
34. (Withdrawn.)
35—B. Seamless copper tubes.
36. (Withdrawn.)
37—A. Sheet aluminum (99 per cent).
38—A. Sheet aluminum (98 per cent).
39—A. Zinc coatings for metal parts.
40—A. Allowance defects in wood seaplane parts.
41. The determination of specific gravity in wood.
42. The determination of moisture content in wood.
43—A. Certified casein glue.
44—A. Airship dope.
45. Airship dope thinner and solvent.
46. Bevel washers, round and square.
47. Naval brass alloy bars.
48—B. Aircraft insignia colors.
49. Aircraft insignia and marking.
50—A. Aircraft wire, strand and cable.
51—A. Alloy-steel, sheet or strip (100,000 TS).
52. (Withdrawn.)
53—B. Aluminum-alloy sheet.
54—A. Aluminum-alloy bars.
55. Aluminum tubing.
56. Mild carbon-steel seamless tubes (low tensile strength).
57—B. Welded steel tubes.
58—B. Mild carbon-steel seamless tubes.
59—A. Medium carbon-steel seamless tubes.
60—A. Turnbuckles.
61. Streamline wire stay rods.
62—B. Universal terminals for streamline and swaged wire.
63—A. Clevis pins.
64. (Withdrawn.)
65. Sheaves for control cable (being prepared).
66—A. Spliced and laminated spruce wing beams.
67—A. Ferrules and thimbles.
68. Rigid terminals for streamline and swaged wire.
69. Shackles.
70. Medium carbon-steel sheet or strip.
71—B. Cold-rolled mild carbon-steel strips.
72—A. Soft carbon-steel sheet or strip.
73. (Withdrawn.)
74. Mild carbon-vanadium steel sheet or strip.
75—B. Powdered aluminum.
76. Light linen thread.
77. Heavy linen thread.
78. Silk thread (grade A).
79—A. Silk thread (size C).
80—C. Airplane spruce.
81—A. Airplane ash.
82. White pine, sugar pine, and western white pine for aircraft construction.
83. Cotton hull sheeting.
84. Cotton pontoon sheeting.
85. Casein for use in certified casein glue.
86—A. Wrapped terminal for nonflexible 19-strand steel cable.
87—A. Spliced terminal for flexible and extra-flexible cable.
88. (Withdrawn.)
89—A. Heat treatment of brazed joints.
90. Brazed joints.
91—A. Brass for brazing.
92. (Withdrawn.)
93. (Withdrawn.)
94. Sandbag duck.
95—A. Aircraft hexagon-head bolts (for bodies and wings, not engines).
96. (Withdrawn.)
97. Aircraft hexagon nuts.
98. (Withdrawn.)
99. (Withdrawn.)
100. (Withdrawn; superseded by SD 24a.)
101. Parachute silk.
102—B. Elastic cord for shock absorbers.
103. Terminal eye.
104. (Withdrawn.)
105. Aluminum wing enamel.
106. (Withdrawn.)
107. (Withdrawn.)
108. (Withdrawn.)
109. (Withdrawn.)
110. (Withdrawn.)
111. (Withdrawn.)
112. Terminal for round steel wire.
113—A. Dirigible and kite balloon cloth.
114—A. Round swaged-wire stay rods.
115—A. Alloy-steel seamless tubes.
116—A. Soldering flux.
117. Hemp rope for balloon riggings.
118. Airplane propellers.
119. Airplane propellers, large diameter.
120. Kiln-drying process for airplane-propeller stock.
121. Woods used in airplane-propeller construction.
122. Walnut lumber for airplane propellers.
123. Mahogany lumber for airplane propellers.
124. Tanguile mahogany for airplane propellers.
125. Cherry lumber for airplane propellers.
126. Oak lumber for airplane propellers.
127. Birch lumber for airplane propellers.
128. Treating aluminum tanks to remove welding flux.
129. Maple lumber for airplane propellers.
130. Soft brass for tipping seaplane propellers.
131. Aluminum fuel tanks.
132. General specification for aeronautical radiators.
133. Naval yellow enamel.
134. Crates for airplanes.
135. Crates for engines.
136. Linen thread.

Miscellaneous Publications

Naval Aeronautic Organization—Fiscal year 1923. Syllabus for The Training of Naval Aviation Observers. Syllabus for the training of Naval Aviators and Naval Aviation Pilots—Airplane.

Technical Notes

Bureau of Aeronautics Technical Notes are now in the process of revision and list of same will be issued upon completion of this revision.

Army Air Service Information Circulars

Following are the latest additions to the list of Air Service Information Circulars. Those marked with an asterisk (*) may be had by money order from the Superintendent of Documents, Washington, D. C. For the balance, apply to the Chief of Air Service, Washington, D. C.

303. Addendum to circular *303 on Discussion of Airplane Tires and Wheels.
* 340. Statistics Compiled from Reports on Crashes in the U. S. Army Air Service during the calendar years 1918-1921, inclusive, and Results of Physical Examinations for Flying during calendar years 1920 and 1921. 5c
341. Description of McCook Field 5-Foot Wind Tunnel.
354. Variation in Performance of a Hispano-Suiza (Model E) Engine with Degree of Throttle Opening.
355. Report of Wind Tunnel Test of DH4b model.
357. Report on Test of Bijur Ignition End Starter for Airplane Engines.
360. Report of Static Test of the Junker L6 Monoplane.
363. Heat Treating Bath Composed of Sodium Chloride, Sodium Carbonate and Sodium Cyanide.
364. Adaptability of the Hyde Welding Process to Steel Engine Cylinder Construction.
366. Emergency Landings from Low Altitudes—Minimum Altitudes Required to Turn Back into Field in Case of Engine Failure after Take-off.
367. Wind Tunnel Test of the Junker L6 Monoplane.
368. Tests of Back Suction and Air-bleed Type Mixture Controls in Flight.
369. The Bellows (Sylphon) Fuel Pump for Liberty 12 and Wright H Engines.
370. Test of a Zenith Carburetor, Model U. S. 52, Fitted with "Plain Tube" and Britton Type Discharge Nozzles.
371. The Physical Properties of Manganese Bronze.
372. Flight Test of an Anti-knock Injector.
373. Test of Curtiss 8 Cyl. Model OX5 Engine rated at 90 h. p. at 1400 r. p. m.
374. Interior Corrosion of Steel Struts and Its Prevention.
375. Curves for Estimating the Fuel Consumption of an Aeronautic Engine on the Basis of Piston Displacement and R. P. M.
376. Methods of making Aluminum Bronze Castings.
383. The Effect of Doped Fuels on the Fuel System, Part II.
384. Effect of Climate on Standard Airplane Wing Coverings.
386. Performance Test of U. S. Mail DHM2.
390. Sediment Deposit in Carburetors.
385 Investigation of Copper-Silicon-Aluminum Alloys with and without Manganese. 27 pp. text, charts and ills.
294 The Distribution of Load Among Spars in Multi-spar Construction of Airplane Wings. 10 pp. ills.
395 Comparison of Column Formulas. 4 pp. text and chart.
397 Bamberg Speed Measuring Station.

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401 Investigation of the Effects on Cylinder Performance of Variation of Position and Number of Spark Plugs.
392 Modified Mark I Airplane Flare 2 pp. text.; ills.
393 Physical and Metallographic Properties of Copper-Zinc-Aluminum Alloys Containing Small Amounts of Magnesium. 5 pp. text.; ills.
402 Aircraft Development Since the Armistice. Airplanes, Armament, Engines, Equipment. 34 pp., illustrated.

N. A. C. A.

Report No. 162 Complete Study of the Longitudinal Oscillation of a VE-7 Airplane, by F. H. Norton and W. G. Brown 5 pp. illust.
387— Airplane Wing Fittings. 20 pp., ill.
389— Pyrotechnic Projector and Ammunition Submitted by Ordnance Dept. for Test

AEROSTATION SERIES

390— Characteristics of Streamline Forms and Design Data for Airship Hulls.
391— Report of Inspection Trip to France, Italy, Germany, Holland and England, By Brig-Gen. Wm. Mitchell, Lt. H. C. Bissell and Alfred Verville.

Information Circulars (Aerostation)

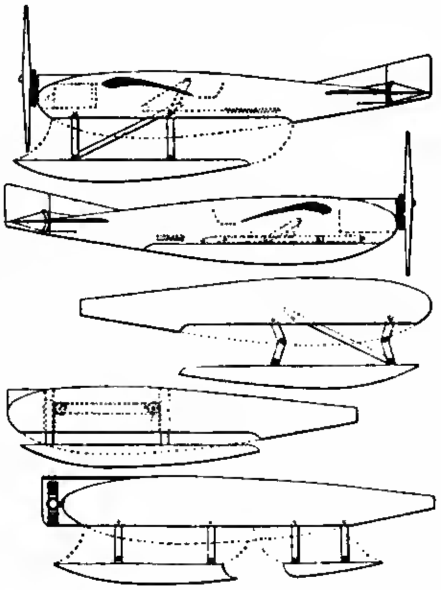
1 Tests of Balloon Fabric
2 Extract from Report of Bureau of Standards Regarding the Recommendation for Filling Balloons
3 Table for Finding the Ascensional Force of Gases
4 Notes Concerning Hydrogen Cylinders
5 Net Tensions
7 Stevens Parachute Pack
8 Aids for Young Officers Commanding Companies.
9 Discharge of Gas from Pipes
10 French Practice in Dirigible Construction
11 Observations from Captive Balloons
12 Gunnery Projectiles
13 Effect of Hydrogen Impurities on Airship Fabrics
Effect of Gases and Chemicals on Balloon Fabrics
14 German Captive Balloon Organization
15 Parachute Tests
16 Balloon Observation in Connection with Artillery
17 Protection of Kite Balloons from Lightning
18 Theory of Ballooning
19 Report of Free Balloon Trip of Kite Balloon
20 Service Instructions for the Balloon Liaison Officers in the Course of an Attack
21 The Air Service in Mobile Warfare
22 Dilatable Type Balloon
23 Useful Notes for Riggers
24 Balloon Information from Italian Army
25 Operations of Allied Balloons in The St. Mihiel Offensive
26 Instructions for the Use of Portable Anemometers
27 The Lift of Hydrogen
28 Report on the Causes and Prevention of Fires in Balloons
29 Fireproofing Parachutes
30 Topography and Perspective for Balloon Officers
38 Electrification of Observation Balloons
39 Characteristics of Streamline Forms and Design Data for Airship Hulls.
40 Comparison of the Air Resistance of the Airship Models C1, C2, RO, SR1 and UB2A.
133 Announcement: Inauguration of Air Service Information Circular (L/A)
135 N. C. L. Observation Balloon Winch
137 General Notes on Organization and Tactics Indispensable to the Balloon Observer
138 Synopsis of General Subjects for Instruction of Balloon Observers.
142 Artillery Notes for Observers
143 Artillery Lectures
144 German Captive Balloon Organization
145 British Balloon School and Description of Protecting Cover for Balloon Rigging
146 Memo regarding Leakage of Hydrogen from Balloons
147 Danger Cone Clamp
148 Artillery Adjustment and Dispersion of Fire
150 Elementary Notes on Artillery
151 Tactics Employed by German Airplanes in Attacking Balloons
152 Instructions for Balloon Group Commanders and Instructions Relative to Balloon Service Record Cards
153 Common Mistakes of Inexperienced Company Commanders
154 Telephone Lines and Equipment for Balloon Companies
155 Information for Maneuvering Officers
156 Translation of German Documents on "Notes of the Balloonist".
157 Hydrogen for Military Purposes.

The Smith Retractible Chassis

REX SMITH is dead. Smith, it will be remembered, was a patent attorney of talent and a man of most lovable disposition who drifted into aeronautics for the love of the "game". Pioneers will recall his early efforts at College Park and the launching of the career of "Tony" Jannus, the intrepid pilot and two-cycle engine wizard. Paul Peck, another intrepid pilot, received his early training under Rex Smith. At the time of his death "Rex", as he was known to all his friends, was employed as an attorney in the Army Air Service. C. C. Hines, another patent attorney of Washington, a close friend and former business associate of Smith's has been taking care of the Smith patent interests.

Rexford M. Smith is claimed, in some quarters, to be the pioneer in the retractible chassis field. The statements of the Army Air Service* as to the great value of such a device, the Martin conspiracy suit, and the various claimants for folding honors, add special interest to the Smith patent.

The leading feature of the Smith invention resides in the provision of



a nacelle which is composed of the airplane's body proper and a supporting base, the parts being so divided and combined that when brought together they form a streamline body, offering the minimum of head resistance.

The supporting base—float or running gear—as a whole is included within the confines or outer contour of the nacelle or fuselage, the two sections forming complimentary portions of each other. The means for spreading the two sections apart and drawing them together, and the means for counter-balancing the supporting section of the nacelle and for locking the sections in fixed relation to each other are merely incidentals, for which any suitable mechanism may be provided.

The patent claims that the system is applicable to aircraft of either heavier or lighter-than-air type, whether designed for land or water use.

(Concluded on page 346)

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The Nordman Sailplane

THE sailplane designed and constructed by H. J. Nordman of Flushing, L. I., promises to be the most successful in America. Trial flights made during the first week of June showed the machine to be well balanced, manoeuverable and entirely airworthy. Real "air sailing" was not possible due to the almost absolute calm air in which glides were made. The first attempt at gliding was made at daybreak, from an elevation of about 150 feet at the golf course of the Belleclaire Country Club, Bayside. Altho not a breeze was stirring, glides of about 1000 feet were made. Later attempts were made one afternoon, but there was not enough breeze to expect soaring flights to be made.

Mr. Nordman is known by many of the readers of AERIAL AGE for his instructive articles on gliders and bird flight which have appeared on the "Soaring Flight" page. Mr. Nordman has gathered extensive data on this subject and his successful design is the result of his studies and experiments covering a period of ten years. He is one of the charter members of the Long Island Flight Association which was organized more than a year ago for the purpose of investigating Soaring Flight. Several members of the club were witnesses of the flights, including George Page, Arthur O. Heinrich, H. B. Shields, R. C. Greenwood, Wm. Schultz and G. F. McLaughlin. The machine was flown by Mr. Heinrich, who is an experienced pilot of wide fame. Heinrich's masterful handling of the plane drew considerable praise from those on hand to see the machine in action.

Brief specifications of the Nordman Sailplane are as follows:

Wing Span ....40 feet
Wing Chord ....54 inches

The Nordman Sailplane in flight

Wing Area ....188 square feet
Total Weight ....200 pounds

The body is of rectangular section, built up with four longerons spaced with spruce struts. Linen covering is used. In the forward part of the body are the pilot's seat, control stick and foot bar, for the rudder, as used in the conventional modern airplane. Light weight has been secured in all control members by a careful calculation of the stresses to be imposed upon them; the parts being designed to be merely strong enough for the purpose with a normal allowance for safety. As the air loads on the control surfaces is relatively small, the control stick required is surprisingly light.

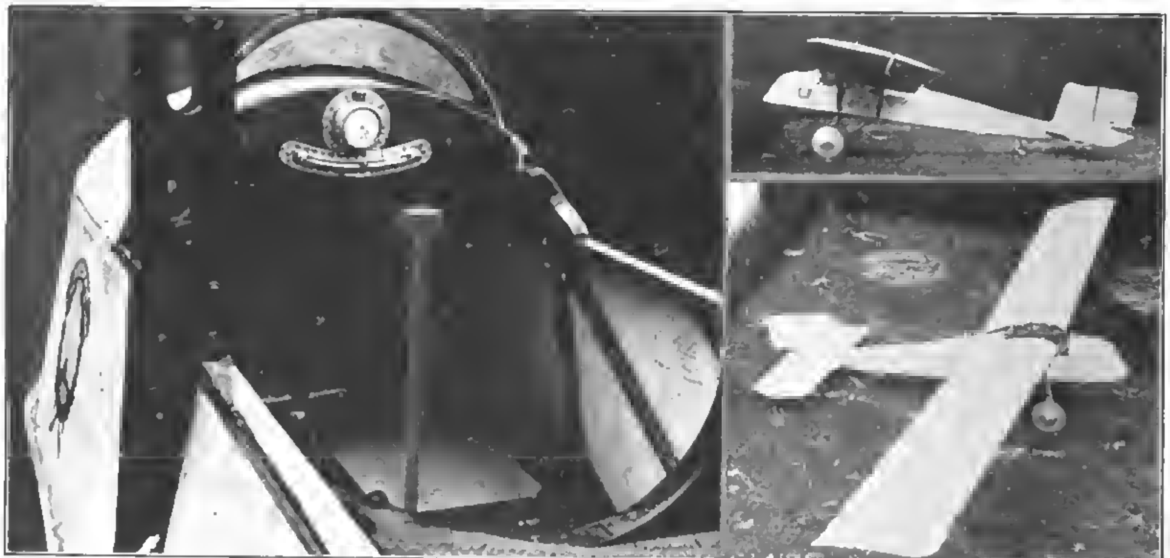
A quick release catch is fixed at the forward part of the machine. In the take-off a tow line is attached at the tow-catch and when the pilot wishes to release the machine he pulls the release wire at the dashboard, the release catch holding the rope opens and allows the line to drop clear.

The method of starting has proven to be very effective. When all is in readiness for flight, the tow line is attached and a group of men are assigned to handle it. This tow line consists of about fifty feet of exerciser elastic cord such as used on the landing gear of aeroplanes. Several men hold the machine while those with the line walk forward, stretching the rubber to two or three times its normal length depending upon the desired initial speed for the take-off. At a signal from the pilot, those holding the machine release it and at the same time the group handling the line, run forward. This results in a rapid climb and when the pilot feels the line loses its effectiveness he pulls the catch wire to drop the rope. At this time the machine has ascended to some thirty or forty feet above the starting point. Under favorable wind conditions, soaring flight is then easily possible. Where there is no wind, the pilot simply heads the machine down and glides to the ground about one thousand feet away.

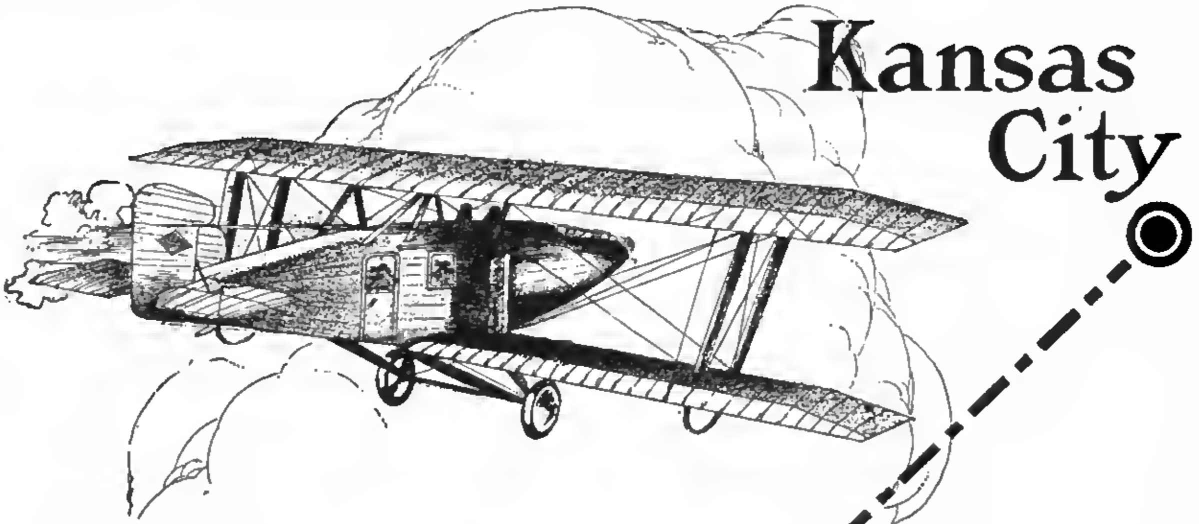
The wings are of constant chord but the thickness varies. A thick curve next to the body is tapered to a fairly flat thin curve at the tip. The wing section is one developed by Mr. Nordman and combines one of the U. S. A. Curves and the Sloane Curve. Much valuable data in this respect was secured from the Smithsonian Institution and the National Advisory Committee for Aeronautics at Washington, D. C.

Complete erection of the wings on the body requires less than half an hour. The monoplane surfaces are braced from below with streamline spruce struts with drift wires between. The wings are built up with lightened spars and a single ply veneer nose. Ribs 18" apart. The trailing edge is of steel piano wire. Covering of doped linen.

Tail surfaces are thick at the roots and tapered to a thin outer edge. The stabilizer has a span of 9 feet 6 inches.



The Nordman Sailplane. The large view shows the cockpit interior, with clock and inclinometer mounted on the dashboard. The conventional type of rudder bar and stick control are also visible.



Kansas City

From Wichita to Kansas City

Another step forward in commercial aviation is the establishment of the Laird Airline Express—an overland passenger route between Wichita and Kansas City.

The big 300 h. p. Laird Limousine, accommodating 6 passengers and a pilot, will develop a speed of 110 miles an hour, making the trip comfortably in two hours and a half.

Overland commercial service is truly inaugurated with this W-KC line. Time will see many more planes taking off on interurban excursions. And like the Laird Airliner, most of them will be protected against wear and weather by the superb varnish, Valspar.

Valspar is the ideal airplane varnish. It is proof against racking vibration, against spatterings of oil, gas and grease, against sun, rain, and fog. It is the only varnish that is absolutely waterproof and it keeps its protective qualities long after other varnishes have perished.

Wichita

The Comfortable Laird Limousine accommodates 6 passengers

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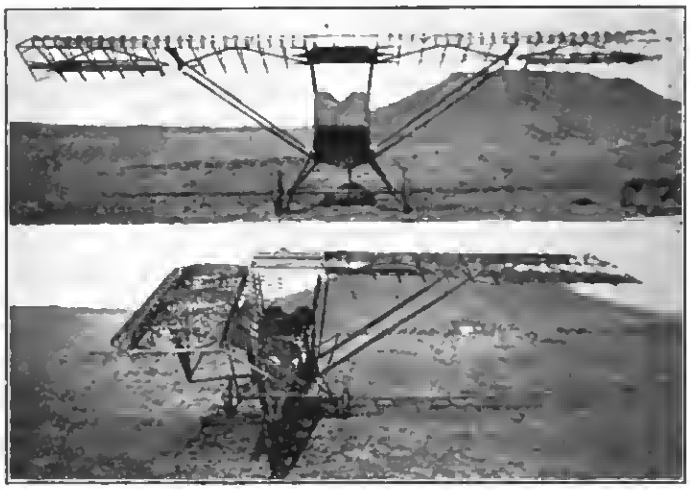
A conventional type of rubber-sprung shock absorber tail skid is used.

Two twenty-inch rubber tired wheels are used on the chassis. The wheels are built of thin veneer, using a standard hub and rim. The chassis consists of a pair of vertical spruce struts with forked lower ends which receive the axle. The axle is attached with exerciser cord. Steel tubes space the lower ends of chassis struts and bracing is secured with diagonal wires and steel tube rear brace struts to the body.

The entire plane is finished in aluminum. In flight it resembles a huge soaring bird. On the afternoon of June 6th, flights were made for several motion picture representatives and reporters from the various newspapers. On one flight the "movie" men assembled near the base of the hill from which the flight started. When "Art" Heinrich got well up into the air the camera-men started to move their machines to get closer to the plane. Seeing this, Art called out "stay right where you are, fellows, I'll come right over you." He made a bank and turned toward the army of photographers, clearing their heads by twenty feet. As a result of his ability to handle the machine, excellent photos of the machine in flight were obtained by all the moving picture cameramen. The voice of the pilot in flight proved a source of amazement to those below and most of the amateur photographers were so intensely interested they forgot about taking pictures.



The "Dakota Girl" a Ford motored monoplane being constructed by C. W. Roberts, Carson, N. D. Span 25 feet, chord 4 feet, length 18 ft. 6 in. Propeller 5 ft. 8 in. Diameter 6 ft. 6 in. fitted.

The Junior Branch of the N. A. A.

The National Aeronautic Association has not only aroused interest among business-men, but even among boys. The Episcopal Academy Junior Branch of the Philadelphia Chapter, National Aeronautic Association of the U. S. A., formed with the help of C. T. Ludington in Philadelphia, is now well under way. All the members are enthusiastic and a charter has been applied for.

Mr. Ludington has given the boys a very interesting talk on his European air travels; the Naval Aircraft Factory at League Island has been inspected, and, best of all, a trip to Lakehurst and to Pine Valley was recently taken. At Lakehurst the boys were thrilled by the size of the ZR-1, and at Pine Valley the majority of the members had their first flight.

The officers of the Junior Branch are: Honorary Chairman, Earlham Bryant, ex-equipment officer of the 20th Squadron, R. A. F. a master at the school, and General Manager, Alfred J. Ostheimer Third. The temporary office, until a club-room can be secured at the school, is at young Ostheimer's home, 2204 De Lancey St., Philadelphia, Pa.

(*Continued from page* 322)

what is to come."

This flight brings home to the business men of this country the fact that they have practically ignored the possibilities of the airplane as the most rapid means of transportation now available. In England, France, Germany and The Netherlands, the aerial freight business is in a flourishing condition. The Army Air Service has already demonstrated the commercial possibilities of the airplane by shipping spare parts for airplanes and engines, clothing, etc., by air in a fraction of the time possible by rail or boat.

(*Continued from page* 343)

The claims of the Smith patent, 1,166,488, application field Dec. 27, 1912, issued Jan. 4, 1916, cover the following points:

A closed nacelle having a relatively movable supporting base portion forming a complementary part thereof and movable up and down with relation thereto; means for adjusting the undercarriage upwardly against the bottom and within the stream-line; an undercarriage comprising fore and aft members; a closed stream-line nacelle having a separable supporting bottom section movable up and down relative to upper section and adapted to be housed within the stream-line of the nacelle; means for raising and lowering; undercarriage shaped to provide a lifting surface while in flight and a surface against which the air acts to press the carriage upward into the body of the nacelle; means for spreading sections apart and drawing them together and means on the upper section for counterbalancing the weight of the lower section; and other.

The idea of alighting gear which could be drawn up is not new. Penaud's patent of 1872 has twin alighting gears which are foldable, but it is claimed by friends of Rex Smith that he was the first to conceive the idea of folding the alighting gear as one unit into the fuselage. One will also recall the OWL —over water or land—hydroairplane built by Curtiss for the Navy when Captain W. I. Chambers was at the head of marine aeronautics—was it not in 1912? If memory serves, this had wheels which folded into the float when used on water.

Nothing ever seems to be new.

New Farman Undercarriage

The most important wood for aircraft construction is Picea rubens, though an excellent substitute is Chamaecyparis lawsoniana, which is slightly heavier. Other woods which play their parts are P. monticola and P. lambertiana, as well as Tsuga heterophylla.

In the old days when pilots had to actually fly we didn't know much about A. amabilis or Tilia americana or even Acer saccharum but now that science has applied its formulae and we have to contend with eight plus per cent fires and all sorts of other things like DH4b's and Martin transmissions, monococci and such, decays in woods and discolorations play their part, according to a new bulletin No. 1128 of the U. S. Department of Agriculture, by J. S. Boyce, pathologist, which can be obtained, including the colored plates, which are a rarely good example of the printer's art, from the Superintendent of Public Documents, Washington, D. C., at 20 cents. Here is a pamphlet of 49 pages of text and colored plates which will make any airplane inspector sit up and take notice. It's a worth-while book.

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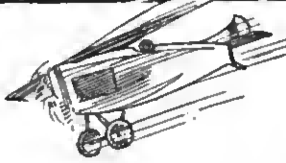
GREAT SACRIFICE SALE!



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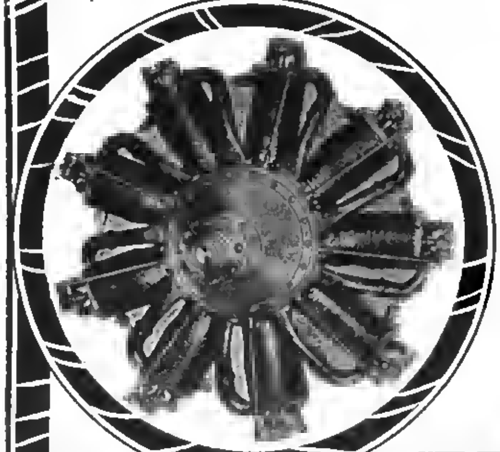

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FLOTTORP	Birch	"	Toothpick	8'4"	5'	3.00
FLOTTORP	Birch	"	D-5000	8'	5'3"	3.00
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WESTMORE	Birch	"	Toothpick	8'4"	5'	5.00
MAHEW Co.	Birch	"	Toothpick	8'4"	5'	5.00
PACKARD	Oak	"	Toothpick	8'4"	5'	3.00
STARR	Oak	"	Toothpick	8'4"	5'	5.00
STARR	Oak	"	D-5000	8'4"	5'3"	3.00
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921 Soft chroma tanned leather with soft leather cape covering neck and shoulders, chamois lined, adjustable straps......5.00
922 Soft tan glove leather extending down over ears and back of neck, extra reinforcement to ouver chin and great part of cheeks, absolutely windproof, adjustable strap and buckle..5.00
923 Soft chrome tanned leather, large ear pieces can be used with telephone set, chamoie lined, very light weight......5.00
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